WORLDS OF TOMORROW

MAY 1966
50c

THE ULTRA MAN

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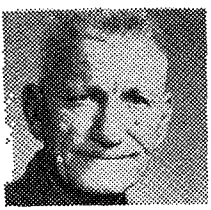

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WORLDS OF TOMORROW®

MAY 1966
Vol. 3 No. 7
ISSUE 19

ALL NEW STORIES

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WORLDS OF TOMORROW is published bi-monthly by GALAXY PUBLISHING CORP. Main Offices: 421 Hudson Street, New York, 10014. 50c per copy. Subscription (12 copies) $5.00 in the United States, Canada, Mexico, South and Central America and U. S. Possessions. Elsewhere $6.00.

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Printed in the U.S.A. By The Guinn Co., Inc., N.Y. Title Reg. U.S. Pat Off.

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WHEN TO MOVE

The other day we spoke to a group of undergraduates at the University of Toronto — fine school; fine group of people — and some of the questions that came up from the audience started us thinking. "Ten years ago in science fiction," said one of the students, "there were a lot of stories about the first space flight, and they all seemed to happen about the same way. Somebody developed a spaceship; a crew got into it; they took off and landed on Mars. But the space program in real life has been building spaceships for nearly ten years now and nobody has yet landed on Mars. How come?"

It was a good question, and we're not entirely sure we gave the right answer. But mulling it over since then we've come to some tentative conclusions about the way *any* major development takes place.

Progress is not linear. It proceeds in quantum jumps. But it often happens — perhaps it always happens — that each quantum of progress is relatively small.

A very good large-scale example of the sort of technological design progress we're talking about appears in the air transport industry. Oldtimers may remember the decade or more during which, successively, a Ford Trimotor and then the DC-3 dominated the business. A war came along, accelerating the pace of aircraft development but putting a temporary halt to the business of re-equipping commercial airlines. Then after the war, and ever since, we have had a steady flow of new designs — piston engines, turboprops, jets — long range, short range; aircraft of all sizes and all varieties. Each represents in some way an improvement over what has gone before — at least, that is the idea of the thing; and if sometimes the improvements haven't seemed much more startling than a Detroit car's new model year, at least *somebody* must see *some* kind of improvement in each aircraft offered for sale, or else the lines wouldn't buy them.

Each new model, then, is a sort of quantum jump. Now put yourself in the place of the chairman of the board of World-Girdling Airways Ltd. Say it is 1950. The British have just come up with the Comet. Do you order a fleet of them right away? Or do you wait a few years until Boeing, Douglas and Convair come up with their jet models. (Remember, you don't know that the early Comets have a distressing tendency to come apart in midair — surprisingly like the way Nevil Shute's fictional Reindeer did

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in that exemplary almost-sf novel, *No Highway*.) Or it's 1958. Do you get in on the ground floor on ordering the Boeing 707 — or wait for Douglas to finish its DC-8, on the principle that the firm that made the DC-3 is bound to have a plane that will delight your passengers and bookkeepers alike? Right now do you re-equip with DC-9-Model 10s or wait six months for the DC-9-Model 30?

At each quantum jump, a decision point, you see. And of course it is not confined to the aircraft industry.

Consider the case of petroleum. The method of extracting crude oil from shale and oil sands is just about ready for exploitation. Problem: the process is only economical on a *very* large scale. As soon as it is employed there will be a temporary overproduction of oil on a world scale. But *until* it is employed we may be facing shortages. At some point the oil industry has to make that quantum jump — but when?

Or consider automated manufacture. Systems now exist for eliminating much overhead in many manufacturing processes. Let us say that a car manufacturer could right now spend a billion dollars and produce an up-to-the-minute 1966 plant, as nearly perfect as it can be made, saving himself a hundred million dollars a year in operating costs.

But his R&D department tells him that if he waits until 1968, he will then be able to spend the same billion dollars in a totally different way, thereafter saving *two* hundred million dollars in operating costs each year. Which to do? When to make the switch. No doubt he could well wait until 1968 . . . but should he not then wait until 1970? Or 2070 . . . when solar energy and automated asteroid ore-diggers may make him a car for practically nothing?

The trouble with the long run, as John Maynard Keynes said, is that "In the long run we are all dead." Obviously we can't wait for the *perfect* system to change to. But the road to corporate success is littered with the bones of board chairmen who guessed wrong, and changed over on the wrong quantum jump.

It happens to be our personal opinion that the United States space program, and very likely the Russian program too, consistenly errs on the side of being overcautious. We all (meaning all people putting objects into orbit, no matter which branch of the human race we belong to) seem to toss a little satellite into orbit and watch it for a while, then a slightly larger one, then the same slightly larger one but with a few instruments instead of several bushels of sand, then a modified one with some chunks of scrap iron, then . . . slowly, painfully, gradually we evolve to a Gemini or a Vostok.

It is unfortunately true that the world's space programs are so constituted that there would be a rather heavy penalty exacted for making a quntum jump that went wrong. If the board chairman of World-Girdling Airways guesses wrong, the worst that happens to him personally is that he finds himself taking up his retirement plan a few years earlier than he had intended.

But if the operating heads of the

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The

Illustrated by LUTJENS

His strange powers were enough to destroy all life on the Moon— but could they save the Earth?

I

The sign on the door glittered quietly. It read:

RICHARD CARR, Ph.D.
Psychologist
Moon Station

Inside the office, Carr — a chubby young man — was at one of the two windows of his inner sanctum, gazing with a pair of binoculars down at the fourth level. A microphone was suspended from a black cord around his neck. From his lips came a steady stream of comments. "— Now, that man is thinking about some technical matter. He wants to

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Ultra Man

by A. E. VAN VOGT

get back to it. But all he says to her is, 'Let's hurry!' Surprisingly, because of a reason I can't read, she wants to get away, too. But she can't let him go that easy. So she's saying: 'Let's walk a little and talk about the future.' The man says, 'I don't see much of a future—'" Carr broke off. "Colonel, that conversation just became very personal. Let's move to someone else."

Colonel Wentworth, at the other window, said, "Any idea what language they're talking?"

"Not really. A Slav language. East Europe. The way the lines in their faces shift as they talk reminds me of—all right, Polish."

Wentworth reached over and shut

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off the recorder, with which through a pick-up device he had recorded the actual words spoken by the people below.

He was a man about six feet tall, 38 years of age, deceptively slim of build, with gray eyes whose calmness partially concealed an alert intelligence. He had been eight years attached to the moon station security staff, but he still had his stiff British manner. Since the American psychologist — Carr — was a newcomer on the moon, the two men had not previously met.

Wentworth now grasped the snooper and peered through its sighting device at the people below. He knew what Carr apparently did not, that what they were doing was probably slightly illegal here on this lunar city, where so many nationalities lived together by international agreements — which did not include anyone having the right to spy on their thoughts as revealed by the expressions on their faces.

Nonetheless, keeping his own face averted from the other — there were thoughts on it that he didn't wish Carr to know about at this stage — Wentworth now said noncomittally to the psychologist:

"We've been going at this for ten minutes. So let's just do one more. See that red-headed woman and the small man?"

Carr did not reply at once. He seemed to be very intent on something below. Suddenly, he said in an amazed tone, "Colonel, that man down there! That tall, gaunt fellow with the headdress — *That man is not a human being!*"

Wentworth was taken by surprise. "What are you talking about?"

He grabbed for his own binoculars, as Carr continued in a high-pitched voice, "Oh, my God, he's become aware of me! He's going to kill me! Watch out!"

Instinctively, Wentworth ducked down and back. The next instant there was a glare of light, brighter than the day outside. Glass shattered. And then there was the rattle of plaster falling.

Silence settled.

Wentworth had been vaguely aware that Carr had also flung himself to the floor. He presumed the man was all right. He wasted no time, but raised himself, crawled to the desk, got the phone down and moments later was sounding the alarm.

II

Boris Denovich, M.D., psychiatrist, newly arrived head of the psychiatric section, listened with a faint frown through the translation machine to what he realized presently was an unacceptable story.

He adjusted his tiny earphone, then spoke into the translation microphone in his thick Russian.

"Are you trying to tell me," he interrupted Colonel Wentworth, "that this young American claims to read *thoughts* from the expressions on the faces of people? Surely, Colonel, you mean mental telepathy?"

Wentworth stared at the intense, middle-aged man thoughtfully. He knew something that neither Carr nor Denovich was aware of. The other's

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reaction was what he had expected. But he'd had to be sure.

Denovich continued: "You've already checked it? Languages and all?"

Wentworth had decided it was vital to give the time to a check-out. So he had spent twenty important minutes in the translation department. He said now, "The languages of the various people I taped were Polish, German, Greek and Japanese."

"And what Carr says they were saying matches the translations?"

"Not word for word, no. But he was certainly getting it straight."

The psychiatrist's thin face seemed to grow thinner. He took it for granted that the security officer had been made the victim of a staged deception by the American psychologist. How, or why, didn't matter now.

Colonel Wentworth was speaking again: "You'd better hear the end of the tape."

Denovich replied patiently, "It's not necessary. I presume he was successful." He frowned. "Colonel, I hope this American isn't just an expert lip-reader, and a linguist."

The security officer directed the broad-faced secretary, "Roll it over to that little slip of white paper." To Denovich, he said, "You've got to hear this, Doctor."

The first voice on the tape, when it started again, was that of Colonel Wentworth. He was directing Carr's attention to another couple. There was a pause. Then Carr's voice made the arresting statement that had, earlier, electrified and galvanized Wentworth.

Denovich sat bolt upright in his chair, as the crash of glass and the explosion sounded from the speaker. He was vaguely conscious of the security officer shutting off the recorder. Then he heard his own high-pitched voice say, "What was that? What happened?"

By the time Wentworth had explained, Denovich was recovered. "This has to be a hoax," he said. He broke off. "Did you look out of the window? What did you see?"

"I was taken by surprise," Wentworth confessed. "I'd thrown myself flat on the floor. By the time the plaster had settled, two or three minutes may have gone by."

"So you didn't see any tall, gaunt, non-human man?" Denovich said satirically.

Wentworth agreed that by the time he returned to the window there was no person on any level below who answered to such a description.

The Soviet psychiatrist leaned back, striving for calm. He realized he was over-stimulated in an unpleasant fashion. It was the closest he had been to anger in a long time. His negative feeling was directed exclusively against Dr. Richard D. Carr, the American psychologist.

Nevertheless, he presently controlled himself and said, "Why don't we just let him experiment with his so-called ability? I'll provide him with facilities. That'll give me a chance to size him up, give *him* a chance to prove himself — and we can go on from there." A grim smile played around his thin lips. "I'd like to give him the chance to read *my* thoughts on *my* face."

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He appeared to be completely satisfied with his proposal and seemed unaware that the matter was more urgent than that to Wentworth. The security officer bit his lips, then said, "I'll get Doctor Carr. We can talk about it."

Wentworth walked to the elevator to meet Carr. As the psychologist came out, Wentworth was standing with his back to the elevator door. When the other greeted him, he glanced over his shoulder in a quick acknowledgement; and then he said, "This way, doctor."

During the walk back to the Russian psychiatrist's office, he not only kept inches ahead of Carr but also held his head so that his face was slightly averted.

As they entered, first Carr, then Wentworth, Denovich hurried forward. His ear piece was fitted for walking and his translation microphone was pinned into one lapel.

On Earth, he had had a technique for greeting people he didn't want to associate with: keep them moving, dismiss them in an offhand fashion as soon as possible, preferably some distance from an exit.

His first glimpse of the plump, unhealthy looking American, and the softness of the pudgy hand which Carr placed limply in his muscular fingers brought no reason for a change of mind. The Russian indicated the hall. "This way," he said.

Carr did not move. He stood, a faint, tolerant smile on his heavy face. Denovich, who had pulled the door open and was holding it ajar, looked back.

Carr said softly, "We'll have to have a better understanding than that, Doctor."

Denovich was instantly cynical. "I forgot," he said. "You read faces and you must be reading mine. What do you see?"

Still with that faint smile, Carr said, "Doctor, would you really like me to say out loud?"

The psychiatrist felt himself to be completely in control. "I'll be glad to let you off that hook," he said good-naturedly.

At this point, Wentworth — who had been anxiously waiting for the barest minimum of the initial confrontation to run its course — decided that it had. He thereupon explained firmly that Carr's ability could be tested as well in a practical as in an experimental circumstance. He finished: "So I'd like you both to accompany me to the Port of Entry —"

Wentworth had spoken the words, while still partly facing away from Carr. He was aware of the psychologist turning and staring at him.

The American said slowly, "Until now, I've respected what I believed to be your personal desire for privacy. But I've had a glimpse or two through that British stiffness in your cheeks, and in spite of all your evasiveness, I detect some thought about me. You know something about my special ability; something —" He stopped, frowning, then said challengingly, "This is not new to you, what I'm doing! Somebody's done it before."

Still facing away, Wentworth said diplomatically, "You're close. Look,

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I'll tell you both the whole story as soon as possible. Right now we've got work to do. All right?"

As he led the way out of the office, Wentworth continued to believe that Carr's ability might still be useful in connection with the alien. But time was of the essence, if he hoped to gain any value from the man's marvelous power.

What neither Carr nor Denovich knew was that, from the beginning of the moon station, a few persons had experienced a sudden, remarkable buildup of ESP or PSI ability. The ability of one person was always different from that of another. This was the first time that the skill had been to read faces. Each time an ability showed, it seemed to reflect an interest that the person had previously had, but now it was intensified to a perfect state. Yet often it seemed so natural to the possessor that he did not immediately report it or even consider it unusual.

The first stage of the ability lasted about two days.

At the end of that time, it faded rapidly and disappeared entirely for several hours. The person even forgot that he had had the ability.

Then — abruptly — the ESP power appeared again, but in a twisted form.

In this form it was a fantastic thing, a highly energized but different version of the original ability.

Wentworth had once described it: "Like an animal in its death throes, achieving briefly the most herculean effort of its entire lifetime, we have in this twist a view of an ESP ability in the nth degree. Perhaps, for a few hours we actually have a glimpse of some incredible ability that man will attain in the far future of his evolution."

The finale now came rapidly. After a few brief hours, the twisted version faded also, and that was the end. The ability never reappeared.

What bothered Wentworth was that he knew Carr had been on the moon approximately 48 hours. He suspected the psychologist had been able to read thoughts on faces for the full time. Therefore, the two-day first phase would end at any moment.

. . . No time to waste! Stop not a minute, now that the necessary preliminaries were done! Do not allow Carr to become confused and distracted by a sudden discovery of the truth, and so therefore keep his own face averted; permit no reading of his thoughts!

III

They headed down to cross-station transport and were quickly whisked to the underground port below the spaceship landing field. As they emerged from the little monorail machine, a man in the uniform of a port officer emerged from a doorway and came along the corridor toward them.

Wentworth recognized him as an old-timer on the moon and nodded greeting. The man acknowledged with a wave of his hand and walked on. Wentworth motioned his two companions to go in the direction from which the port official had come. Denovich complied at once. Carr

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took several steps, and then he stopped and looked back.

"Colonel," he said, "may I speak to that officer?"

"Who?" Wentworth had already forgotten the chance meeting.

"That port officer who just passed us."

"Peterson? Oh, sure!" He turned. "Hey, Pete," Wentworth called.

But Carr was loping along the hallway. By the time Denovich became aware that something was wrong and faced about, Carr and Peterson were already talking. The man in uniform nodded twice and then abruptly laughed hysterically.

The sound of laughter came unexpectedly loud. Some people who had come out of the baggage room stopped and stared.

As Denovich watched, astounded, Peterson burst into tears. Denovich, acutely aware of how tense his thin body felt, walked back to within a few feet of the two men. He was vaguely aware of Wentworth joining him.

The port aide was bawling noisily and at the same time trying to control himself.

He sobbed: "What did you say? I didn't catch your words . . . Say, what's happened to me? I never did a thing like this."

He gulped, made a tremendous effort — and was instantly in a rage. "You so-and-so!" he snarled. "What did you do to me?"

"Somebody came through here yesterday afternoon and took control of your mind," said Carr. "Tell us about it."

"Wel-l-ll!" Peterson seemed to forget his rage. "Oh, you mean those Negroes. Three of them. One was kind of odd looking — hollow-cheeked, you know — and so I asked him to remove his headdress."

He stopped, blinked at Carr, his jaw lax, face almost stupid looking in his puzzlement.

Carr urged: "What did he do to you?"

"Why-uh!" The man's eyes widened. "He shot a light beam at me — right out of that thing on the top of his —"

Once again he stopped, looking blank. Then: "What am I talking about? I must be dreaming!"

Denovich walked forward. There was no longer any question in his mind as to what Carr could do. He had witnessed — it seemed to him — the fastest hypnotic induction of his experience.

He said in a low, angry voice, "Doctor Carr, get away from that man!"

Carr half-turned, startled. Denovich almost felt the other's eyes search his face. Carr said, "Oh!" Then firmly: "One moment, Doctor?"

He turned back to the port official. "Go to your quarters and lie down. If you don't feel better in an hour, come and see me in my office." He handed Peterson a card.

Carr faced Wentworth. "I think we'd better talk to the Chief of Port of Entry," he said.

The Chief of Port of Entry was considerably heavier looking than Carr. He was an Italian, good-natured, efficient, subjective. His

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name was Carlo Pontine. He ignored Denovich's translator and instead spoke into his own personal translation microphone.

"Those three Africans arrived from Vastuland." He put up his hands in the gesture of helplessness. "So you have your problems, gentlemen."

Wentworth, who had already called out the black contingent of Security, knew what he meant. The alien had either been very clever or very lucky to arrive as a Negro, for normally that would give him the protection of race tension. Their main hope was that Carr's ability would bypass such barriers.

Pontine had photographs of the three Vastulanders; and there, unmistakably, was a gaunt, colored figure with a headdress. The appearance was of an unusually elaborate Mohammedan-style head decoration. The cloth came down low over the forehead, and the face — it was dismally plain to see — was only superficially human.

Blown up on a large screen in the projection room, the black pigmentation showed plainly. Underneath was a scaly skin.

Moments later, an uneasy Wentworth was showing the photo on the security band of the port's TV intercom. Having given his tense account, he turned his special TV key to its second position. One by one the lights on the "key" went out until only two remained blinking. Which was pretty fair emergency coverage.

Wentworth visualized the scene out there. In dozens of sectors of the great moon station, his men were stepping out into corridors, glancing into departmental offices, surveying their territory. More important, if one of them had previously observed the wanted person, he would now be checking if he were where he ought to be.

Even as he had the thought, a buzzer sounded softly and a light came back on. Carr pressed the button and found himself staring at the clean-shaven young man — Ledoux — in the French section.

"Colonel Wentworth."

"Yes?"

"That man was assigned an apartment in this sector yesterday afternoon. However, he went out an hour ago, and I haven't seen him since."

By the time that message was completed, another light was blinking. That message was:

"Saw him about thirty-five minutes ago, walking rapidly into R-1."

Wentworth groaned inwardly. R-1 was the main residence complex for visitors. It had fifteen hundred and forty-four apartments, most of which were at the moment unoccupied. But an imaginative artist had originally designed it to be futuristic; and a committee untroubled by knowledge of security had authorized its construction. With its innumerable corridors, back stairways, patios, its three dozen restaurants, its four theaters, sunken gardens and lovers' nooks and moon surface transport cars — it was a veritable sieve with hundreds of openings.

R-1 was easily the safest hideaway in Moon City; and it was their mis-

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fortune that the alien had located it and had taken refuge in it. Gloomily, Wentworth turned the TV control key back to its One position and called for General Alarm H.

The instant that was done, he turned, grabbed Carr's arm, beckoned Denovich and — face still averted — said breathlessly, "Come along!" He led the way back to the elevator.

His first and best hope was a swift search, using every means. Carr's ability — which had already proved itself — was one of those means. What made it a possible hope was that, because their part of the moon was turned away from the sun, only thirty-eight of the apartments in R-1 were occupied. Wentworth personally preferred the moon during its night period with its magnificent view of Earth. But it was their good luck at this decisive moment that tourists did not share his opinion.

Briefly, Wentworth explained what he had in mind. The pattern was: When the door opened, Carr was to read the face of the person who answered while Wentworth asked questions.

As it worked out, usually before the individual could reply, Carr said, "Nope." The instant he did that, a security aide took over; and Carr, Denovich, Wentworth and their accompanying squad raced on to the next occupied apartment.

The idea was that someone would have seen the alien.

The door of the seventh apartment was opened by a small woman, who stared at them questioningly. She wore a prim, black dress, and how anyone had ever persuaded her to make the dramatic tourist trip to the moon, Wentworth would never know. But then he was often amazed at the types that showed up.

He saw that Carr was hesitating. The psychologist seemed momentarily confused. Then: "He's inside," he said.

Somebody grabbed the woman and jerked her out of the door, instantly covered her mouth, stifling all but a faint squeal. Seconds later, at a signal from Wentworth, the men in the mobile unit rolled up on their silent rubber wheels. Without pausing they went straight on into the apartment.

As he crouched beside the door, waiting, Wentworth was vaguely uneasy about the order he had given: to strike and strike hard. The thought that was suddenly in his mind was: here was a representative of another race, the first ever to show up in the solar system. Ought he to be killed out of hand?

After a moment's consideration, he allowed his doubts to fade. The alien had instantly tried to kill Carr, when he was discovered; and, equally culpable, he had come secretly into the moon station. The creature's approach was hostile and must be dealt with in the same way.

His thought ended in a horrid thrill of excitement, as he suddenly felt the peculiar crawling sensation in his skin that came from the mobile unit's electric vibration mechanism. It was a full-charge feeling.

As Wentworth was silently congratulating himself, the hallway suddenly lit up to a dazzling bright-

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ness. The doorway blazed with a direct sunlight brilliance.

The blinding light ended as suddenly as it had begun. A minute went by. There was the sound of debris falling but no movement. Pale, concerned, taut, Wentworth waited.

IV

What had happened was, a few minutes earlier Xilmer had realized that the moment of confrontation could be at hand — if he wished. He thereupon sent a message by way of the device in his headpiece to the *giyn* — battleship — in orbit far out beyond the moon. In asking for instructions, he said:

"Only one thing bothers me about this spy visit of mine. Somebody detected me from a room high up in one of the building structures an hour ago. His ability to do so suggests that there are two types of beings in the moon station. One group — the main mass of people — is unimportant. However, the second type of being — one of whom spotted me, and from a distance at that — could be a more powerful life form. So I think I should escape through a wall of this apartment and attempt by all possible means to make my way to the room from which that superior type observed me. I really believe I should size him up before any irreversible decisions are made."

The reply was grim: "Twenty-four hours from now, the fleet will risk one minute of sub-space communication. We must be ready to tell them to come here, or go elsewhere."

Xilmer protested, "I plan to proceed cautiously, breaking through walls and so on, to avoid corridors. And before I leave, I'll try to erase the memory of my presence from important personnel here. Even at worst, that should all only take a few hours."

"Nonetheless, why not test their weaponry for just a few seconds? See what they've got in such a situation?"

"Very well."

Wentworth gazed around at the shambles with a sinking sensation. Then he turned to the two dazed men who had scrambled out of the wrecked mobile unit.

"What happened?" he asked.

Surprisingly, they weren't sure. They had seen the man-like figure, as the unit drove into the living room of the apartment.

Sergeant Gojinski shook his head, as if to clear the mists from his mind. Then he spoke in a shaky voice through his own translation microphone: "There he was. I saw him looking us over, and he wasn't afraid. I pointed the lightning rod at him — you know — uh —"

It was a slang term for the mobile unit's aiming device. Wentworth nodded, urgently.

"So then I said, 'Fire!' " continued Sergeant Gojinski. "I saw the vibration bolt reach out to him. And then something bright hit the unit — us. I guess I was stunned. When I could see again, there was the hole in the wall, and he was gone."

The other man, who was from South America, had had the same experience.

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Listening to the accounts, Wentworth felt a chill. There was an implication here of casual weapon superiority. Undecided, he walked over to the gaping hole in the wall. The interior steel construction had been cleanly sliced through. He held his geiger counter toward it, but it remained as silent as it had throughout.

Here was evidence of incredible power without radiation.

Slowly, Wentworth braced himself. The moon station had a dozen mobile units stored against an unnamed emergency, but they would have to be charged up; which would take somewhat over an hour.

He explained his plan quietly to the men around him. "We'll use several mobile units with each search crew."

He used his TV key on the nearest communicator and issued a specific order: "All observers stay at your posts. As soon as the supplementary mobile units are ready, call me at—"

He hesitated, then he gave Dr. Denovich's address.

He was aware of Carr coming up beside him. Without looking at the plump man, Wentworth said, "Doctor, I want you to remain well in the rear of future action. Let's remember that when this being spotted you observing him, he immediately tried to kill you. Apparently, he has not considered it worthwhile to attempt to exterminate anyone else. That's got to be significant."

Carr said in a nervous tone: "You don't think he was just surprised into striking at me?"

It was, of course, possible. But Wentworth was not prepared to take the risk.

Beside him, Carr continued uneasily. "There's something I should report. When I first looked at that little woman's face, just for a second it seemed as if I couldn't read it. Do you think that alien had some way of scrambling her thoughts, so that her face didn't display them?"

Wentworth felt sorry for the plump man, for obviously the partial failure meant that the ESP ability was coming to the end of its initial stage. It was a cruel prank of fate, but—equally obviously—the time had come for Carr to understand his situation.

Deliberately, he faced the psychologist and said gently, "Why don't you read me, Doctor?"

Carr gave him a quick look. Then he frowned, and then some of the color drained from his cheeks.

He said at last, unhappily, "I'm having difficulty, and it's a pretty complicated thought. You're thinking that my ability to read faces is a—a—"

He shook his head, bewildered. "I don't get it—a common stereotype? That doesn't seem right."

The near miss established once more for Wentworth that the marvelous ability was beginning to disappear. Aloud, he said, "Let's go to Doctor Denovich's office. I'm sure I now have time to tell you both the whole story."

An hour later, there was still no call to indicate that additional mobile units were ready; and he had finished his account.

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Carr's face had a blotched look, and his lips twitched. He had the appearance of a man confronting an unpleasant truth. He mumbled, "It all seemed so natural. I've thought about people's expressions for years."

"When did the ability actually start?" asked Wentworth.

"Well," Carr muttered, "it was when I was studying the faces of the other passengers on my way to the moon two days ago that the pieces started to fall into place. When we landed, I had the entire system worked out on a practical application basis."

"So it was just a few hours short of the two days when you finally called me. And so the ability is now in its fading stage; and the twist will show up in a few hours."

Carr grew even paler, if that were possible.

He said thickly, "But what form could such an intensification of face reading take? I can't imagine anything more complete than what I have been able to do."

Denovich, thin face taut, thin body tense as he leaned forward, interrupted harshly: "I feel outraged by all this secrecy. Why was I not briefed on arrival? Why has there been no previous publicity on this important matter?"

The English security officer pointed out stiffly that the moon station in its present form was now only eight years old. Space travel was still new. People were easily alarmed. Such a freak happening might have been a great setback. However, the information blackout was now going to be ended. A joint paper had been prepared by their predecessors. This was to be given to the world press after it had been cleared by the U.N. Security Council.

"And," Wentworth continued, "as for briefing you and Doctor Carr — I intended to do that after you had guessed that one of you would be — uh — a victim of the condition?"

Under the circumstances it had seemed credible that it might be a genuine system, as worked out by an expert.

Wentworth smiled his faint smile. "I hope, Doctor Carr, that you kept records."

"I have complete notes," replied Carr glumly.

"It will be the first time," said Wentworth. "So we have a win."

Having made the comment, he spread his hands almost helplessly. "And there's your story."

He stood up. "I think I'd better go and see what progress is being made on those mobile units." He addressed himself to Dr. Denovich. "Keep an eye on your colleague, sir."

The psychiatrist nodded curtly.

When the two men were alone, Dr. Denovich gazed at the plump American with a hint in his manner of personal concern.

"This seems to have been quite a shock to you, Doctor Carr. Why don't I give you a mild sleep potion, so that you can be in a relaxed state while the ability is fading?"

Carr studied the older man's face with narrowing eyes, "My ability may be fading," he said, "but you ought to be ashamed of yourself for what I think you're thinking."

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Denovich protested. "I'm sure you're reading me wrong."

"You intended to get my notes while I slept," the psychologist accused.

"I *thought* of your notes," admitted the Russian, "and realized how important they were. It did not occur to me that you were not planning to share them."

Carr muttered, "I guess what I saw could have meant that." He broke off. "I apologize. Look, we're both on edge. So let's take a look at the situation."

As he analyzed it, here were two experts confronted by phenomena. Why didn't they sit down, and keep a moment by moment record of the fading of the special ability?

"Perhaps," he concluded, "by continual discussion and restatement, we can prevent my memory from fading."

It was an excellent idea, and the two men settled down. For two and a half hours, the plan seemed to work, in that there was no apparent memory fading.

Then the phone rang.

It was Wentworth, reporting that the search parties had finally been augmented by additional mobile units. The security officer asked, "I wondered if you cared to come along?"

Denovich explained that what Carr and he were doing was too important to leave.

When he turned from the phone, he was startled to see that the psychologist was leaning back with eyes closed. What was startling was that his body seemed limp. Denovich bent over the man, shook him, but there was no quickening of wakefulness. A swift examination established a sleeping man's pulse, the slow, deep breathing of sleep.

Dr. Denovich wasted no time. He prepared a syringe and injected a sleep potion in the American's arm. Then he dispatched his secretary on a research errand that would keep her away from the office for the rest of the day. Quickly he searched the unconscious man, found his key ring; then, picking up his copying camera, he headed along the hall and up the elevator to Carr's office in the American section.

He had no sense of guilt. "This is not a moment to be squeamish," he told himself. National interests—paramount.

He found the notes almost at once. They were unexpectedly voluminous. Expertly, he set about his task. Half an hour later, he was still intently copying one sheet after another—when he heard a faint sound behind him.

Denovich was not to be rattled. He turned slowly. And then a thrill of fear struck through him.

A figure stood there.

How the creature could ever have been taken for human was not clear to the startled Russian. The gauntness of the body was unnatural; the face, blackened as it was, did have something human in it. But the legs under the long gown showed . . . wrong—the way the cloth lay against them and outlined them! His physician's eye recorded the details in a single, flashing look.

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The next instant a voice from the headpiece said in Russian, "Where is—" hesitation—"Doctor Carr?"

Denovich had not in his entire life had a single desire to be a martyr and he had none now. But, as in the past, he faced the Communist dilemma. Party doctrine required that he do what was necessary "for the people" in any situation, regardless of personal danger. Failure to do so meant that he would have to attend a self-criticism meeting and explain his dereliction.

He had long ago solved the problem by a simple, quick analysis on the spot by one yardstick: the chances of discovery.

No chance of that here, he decided. But he deduced in a single, continuing evaluation that his only way of escape from this baleful being was total collaboration, and he had but one anguished hope: *Maybe he'll let me live.*

"Eleven floors down, the Russian section—my office—422-N." He spoke hoarsely.

The creature gazed at him somberly. Then, contemptuously: "Don't worry. We're not after people. And, in view of the secret computation you just made, I'll leave you your memory."

A flash of indescribably bright light from the headpiece struck the psychiatrist's forehead.

Blackout!

V

It took a while for Xilmer, by his careful method, to read 422-N. But presently he stood over the man lying on the couch and sent a message, describing Carr's unconscious state.

"So far as I can see, I could destroy him without him or anyone else being able to prevent it."

"Wait!"

There was a silence of several minutes, then: "Tell us exactly how his unconsciousness came about."

Xilmer dutifully reported what he had perceived in the psychiatrist's mind about the special ESP aspect, and how Denovich had injected Carr with a strong sedative. "It is this sedative that puts his body at our mercy."

He concluded, "He seems completely helpless, and I strongly urge that he not be allowed to awaken. Who knows what the ESP twist would be?"

"Wait!"

Again the receiving unit on his head stilled; finally:

"According to our calculations," came the message, "this human being has had time to go into the advanced ESP state, which apparently is a part of his cycle. So before you do anything, examine what is going on in the lower brain."

"I have already done so."

"With what result?"

"Despite his unconscious condition, something inside the brain is observing me and, I would say, is monitoring this conversation.

. . . But there were no energy connections strong enough to control power flows. So Carr could not fight back. Whatever the twist was, it was not in itself a weapon capable of causing an impact.

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Xilmer concluded grimly, "I think we can safely say that, if we do not permit this man to awaken, the inhabitants of this star system cannot defend themselves."

"Too bad!" was the laconic, unsympathetic reply.

They grinned at each other mentally through the head mechanism, and enjoyed the feeling of total superiority.

"What is the recommendation?" Xilmer asked, routinely now.

"Kill him!"

When Denovich came to, he was lying on the carpeted floor.

He raised himself and looked around. He was greatly relieved when he saw no sign of the alien. Trembling, he stood up and went to the outer door; peered out. Nothing. Not a soul in sight.

Fighting panic, he collected his equipment, but hesitated as he realized that his copying task was not completed. After a moment's thought, he picked up all the psychologist's notes, including those he had previously photographed.

As he hurried along the hallway, he glanced at his watch for the first time. It was two hours since he had been rendered unconscious. That was briefly startling. He thought, shocked: "The creature has had all that time to find Carr in my office."

He expected to find his quarters damaged. But at first look, everything was in order. Hastily he locked up the stolen notes, then went through the door to the treatment room, where he had left Carr sleeping.

There was no one on the couch.

Denovich was about to turn away, when he saw the object lying half-hidden on the far side of the little cot. He walked over and looked down at Xilmer's turban. The cloth was disarrayed and stained by a bluish fluid, and a metal structure was visible through the folds of the silk-like stuff.

After a moment, he saw that the blue carpeting was heavily encrusted by more of the dark blue liquid.

As he stood there, undecided, voices sounded in his outer office. He recognized Wentworth's British baritone, and then Carr's softer voice. Denovich turned and faced the entrance. Seconds later the two men entered.

The Soviet psychiatrist was aware of several other men crowding the doorway, but they stopped short of it. He had seen only one of them before—recognized him as a Russian member of the security police. Their gazes met, held for an instant, significantly, then separated.

Wentworth said, "Oh, here you are, Doctor."

Denovich said nothing. He was gazing tensely at the face of the plump American, thinking: "Right now, *this instant,* he's in this superstate."

And, if Carr had been able to read thoughts on faces before, what he could do now must be so far in advance that his—Denovich's—every act of the past few hours was as plainly visible to the other as a picture on a screen.

The Soviet psychiatrist cringed, then braced himself. Denials rushed

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to the tip of his tongue and waited there, ready to be spoken.

Wentworth was continuing: "Doctor Carr is puzzled, sir. When he came to he was lying on this couch, and he had no idea how he had got here. But that—" he indicated Xilmer's turban— "was lying right there. As he went out, he saw your name on the door. That's how he knows you, because, of course he has no memory of the first stage of the ESP. What happened?"

Even as Wentworth was talking, Denovich's mind began to race around seeking a plausible explanation for his own whereabouts. But he knew better than to make a quick answer. And so, as the English officer ceased speaking, Denovich addressed Carr.

"Are you all right, Doctor?"

Carr gave him, perhaps, too long a look before answering, but when he spoke he said simply, "Yes."

"You're not hurt?"

"No. Should I be?" His eyes were, of all things, shifty, uneasy, puzzled.

"What about the, uh, twist?" Denovich said.

"The what?"

Denovich was thunderstruck. What he had expected, he didn't know. But not this!—this ordinary person, with ordinary, everyday responses. And no memory.

"You mean," he said, "you have no awareness of anything unusual?"

Carr shook his head. "Really, Doctor, I think you have more information on this matter than I. How did I get into your quarters? Have I been ill?"

Denovich turned and stared helplessly at Wentworth. He had his own story ready now, but he felt too bewildered even to offer it.

"Colonel," he said, "if you will fill me in, I'll do the same for you."

Wentworth did so succinctly. After the phone conversation, he had accompanied one of the parties scouting for Xilmer. A few minutes ago, Dr. Carr had been seen wandering along a corridor; and since people had been forbidden to leave their apartments, Wentworth had been called to deal with the situation. He had come at once.

"Naturally, knowing where he had last been, I asked him what had happened, and of course, discovered only that he had awakened and seen this turban and all that sticky stuff."

He bent down, touched the bluish liquid gingerly with the tip of a finger, and when apparently it did not hurt him, raised it to his nose and sniffed. He made a face.

"Must be the blood of this race," he said. "Quite a strong odor."

"What race?" Carr asked. "And, look, gentlemen, what—"

That was as far as he got. At that moment a voice spoke from Xilmer's headpiece in English.

"We have been monitoring this conversation, and it would appear that an accident has befallen our agent."

Wentworth stepped forward quickly. "You can hear me?" he said.

The voice continued, "Give us an exact description of the present condition of our agent."

Wentworth replied firmly, "We're quite willing to do so. But in return

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we would like some information from you."

"We're only about three hundred thousand miles away. You'll see us in slightly less than an hour, and unless your explanations are satisfactory, we shall blast your entire station out of existence. Now, quick!"

The threat was chilling, and instantly convincing. One of the men at the door said, "My God!"

Wentworth, after a long, tense moment, described in an even tone exactly what was left of Xilmer.

When he had finished, the voice said, "Wait!"

At least three minutes went by; then: "We must know exactly what happened. Interrogate Doctor Carr."

"Me?" said Carr, his voice scarcely more than a croak.

Wentworth made a ssssh gesture, then silently waved the men in the open door away, and then nodded at Denovich and Carr.

"Get it out of him!" he commanded Dr. Denovich, then he tiptoed from the room and headed for the phone in the psychiatrist's private office.

As the Russian faced Carr, he was aware of the Englishman's muffled but earnest voice sounding the alarm. Consciously, he shut out the other's voice and gazed at Carr.

"Doctor," he said, "what is your last recollection?"

The American psychologist swallowed, as if something unpalatable was in his throat; it was that much of a grimace. Then he countered: "How long have I been at the Moon station?"

Dazzling lights of understanding blazed through the psychiatrist's mind. "Of course," he thought, "he really doesn't remember anything after he got that first ESP on his actual journey to the Moon."

His recollection flashed to a question Carr had asked a few minutes before, about being ill. "Of course," Denovich thought again. *"He must think he's mentally ill!"*

He stood then, trembling with the possibilities of his lightning analysis, and he tried to visualize how he himself might feel in Carr's place.

Instantly he realized the other's problem. An American psychologist confessing to his Soviet colleague that he believed himself to be mad!

Denovich said gently, "Doctor, in what way do you think you're crazy?"

When Carr hesitated, the psychiatrist urged: "Our lives are at stake. You must not hold back."

Carr sighed. "I have paranoid symptoms," he said. And he sounded suddenly tearful.

"Details! Hurry!"

Carr smiled wanly. "It's really very extreme. When I awakened, I became aware of signals."

"Signals?"

"Everything means something."

"Oh, that one!" said Denovich. He added, "For example?"

"Well, I look at you, and you're just one mass of—well—meaningful signals. Even the way you stand is a message."

Denovich was baffled. What Carr seemed to be describing was certainly only a variation of a routine paranoid stereotype.

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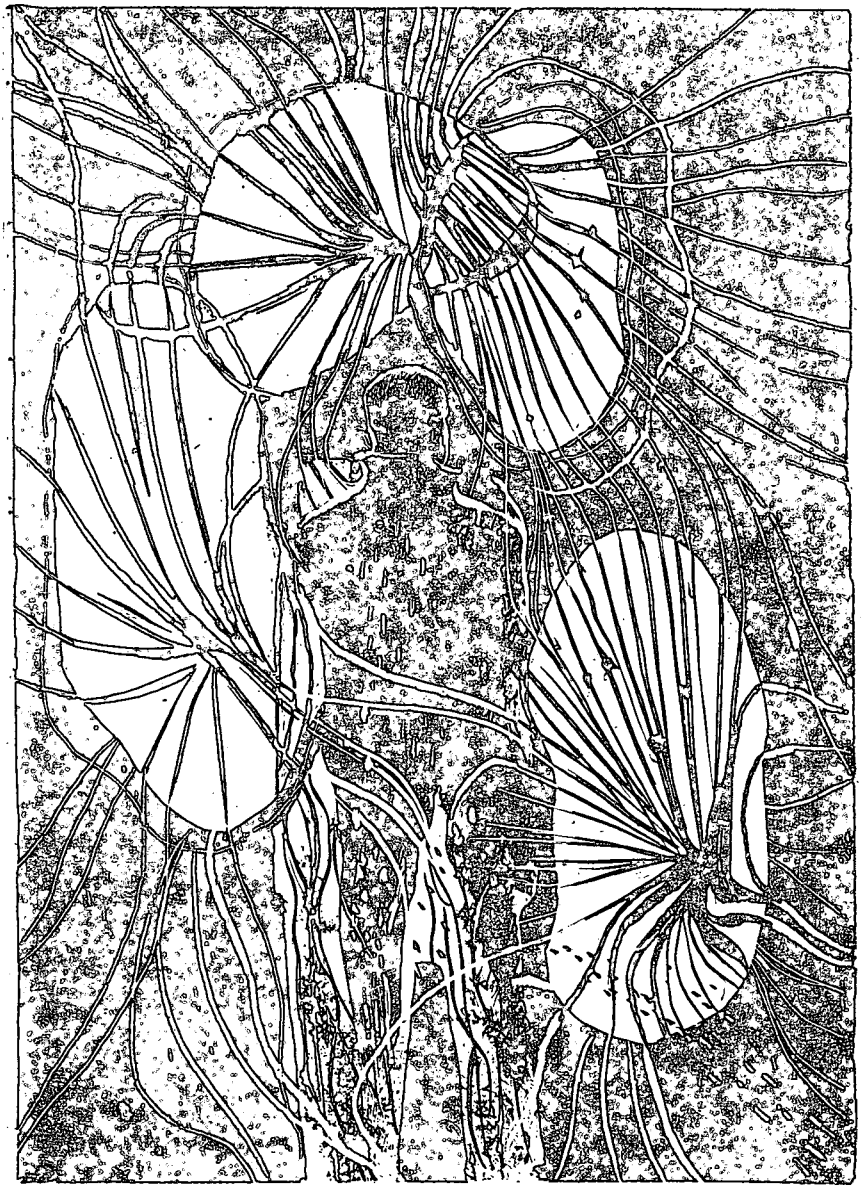

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Was this the famous second stage of the ESP cycle, which—he had to admit it—had been so convincing in its initial stage?

He caught himself. "Explain further," he urged.

"Well—" Carr paused, his pudgy face showed helplessness. "Well, your pulsations!"

As he haltingly explained it, Denovich's body was like a large mass of energy circuits that gave off a set of signals.

Carr looked at the man, and at the surface signals in the exposed part of the body. And *through* the skin to the atomic structure inside: tiny golden balls in stacks of billions to each cubic millimeter, pulsing and signalling—and connected . . . .

Connected by quadrillions of force lines to distant stars, to the near universe, already stretching out, shiningly tenuous, to other people on the Moon station.

But the overwhelming majority of the lines curved off through the walls and across to the earth . . . A solid mass of connections with other people and with all the places Denovich had ever been.

The signals that pulsed along some of the lines were intense, Carr followed one of the more powerful complexes to an earlier year in Denovich's life, to a young woman, with tears streaming down her face.

The thoughts that came along that set of lines were: "I trusted you and you betrayed me!"

"Now, Natasha—" said that younger Denovich.

"You see—" said Carr, helplessly. He stopped. "What's the matter?"

The Russian psychiatrist wondered if his face looked as bloodless as he felt.

"What? W-what?" he gasped. He was stunned. Natasha was a girl he had got pregnant in his younger days and she had died in childbirth. With an effort, he controlled himself. "Can you do anything with it?"

"Well—yes, I guess so."

As he spoke uncertainly, Carr did something that cut the bundle that connected with the girl and watched the lines recoil back upon Denovich like a rubber band, suddenly released.

Denovich uttered a cry; he couldn't help it. It was a cater-wauling sound, with a bass, throaty yowl in it, that brought Wentworth out of the other office on the double.

By this time, Denovich was trying to reach the couch. But his knees buckled. He fell to the floor and lay there, at first writhing and moaning. But all at once he began a mad screaming.

The Russian agent pressed into the room behind Wentworth and stood there with bulging eyes. After a moment, Wentworth returned to the phone and called Medical Emergency.

The two men who came injected the insanely screaming body with a sedative. The screaming died down to a sobbing sound and then silence. They carried the unconscious man out on a stretcher to a small, mobile unit, called an ambulette and rode off with him.

The machine in Xilmer's helmet spoke: "We absolutely require that

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Dr. Carr explain what he did to Dr. Denovich."

Carr gazed helplessly at Wentworth. "I just cut the lines. I'm guessing that, instantly, all the barriers he had between himself and that girl went down. I think that what we saw was the effect of total guilt suddenly breaking through."

"Wait!" said the voice from the Xilmer turban machine.

Wentworth, who could not forget that Xilmer's headpiece had energy weaponry in it, silently waved everybody out of the room. He himself backed into position beyond the door jamb.

One minute. Two. Then the voice spoke: "Unquestionably a powerful mental force exists in Dr. Carr. The analysis of Xilmer's death was that the unconscious mind of Dr. Carr defended itself from him by cutting the energy lines involving the execution intent of Xilmer. Hence, a reversal was induced, whereby he promptly used his *mirt*—a weapon in his headpiece—to commit suicide. The condition of his body indicated that almost total dissolution occurred."

Wentworth turned to Carr. "Any comment about that?" he whispered slowly.

Carr shook his head.

"No memory of it?"

Again, the head shake.

The voice was continuing, sarcastically, "Naturally, we shall wait until this man's remarkable mental gift runs through its cycle, a few hours from now. You shall hear from us then."

Silence.

VII

Two hours; perhaps less.

Other men came. There were tense conferences. Carr sat off to one side. Presently, as the voices grew more urgent, he slipped away into the room where Xilmer's turban lay and stood with eyes closed, gazing at a universe of countless—signals.

Billions of these—pulsations—still lingered around the machine in Xilmer's headpiece. Quadrillions of lines were focused on it from somewhere out in space.

Carr glanced along the lines with a casual ability. Now that he was no longer disturbed by the mental phenomenon itself, he was aware that there was a faculty in his mind which could understand the meaning of millions of lines at once.

He saw with total clarity that signals and pulsations were merely a surface activity of the basic universe structure.

Underneath was—truth.

Between the signals and what they represented was an intricate feedback, an interchange of the surface meaning with the colossal fact below.

He was aware of Wentworth coming up beside him. "Doctor Carr," the security officer said softly, "our discussions have led us to the launching of nuclear missiles from the U.N. Space Station hovering over the Atlantic. These will be available close to here in about five hours, but in the final issue our real hope comes back to you and what you can do. What *can* you do?"

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"I can—experiment," Carr answered, "with signals."

Wentworth experienced an intense disappointment. For signals, it seemed to him, were a part of communication, and not of weaponry. And that, he realized bitterly, was obviously logical. Beginning with the reading of thoughts on faces the American psychologist had now, in the twist, come to some ultimate ability to understand and manipulate communication.

It was a great gift, but it was not what was needed in this fantastic emergency.

"What kind of experiment?" Wentworth asked.

"Like this!" said Carr.

And he disappeared.

Wentworth stood tense. Then, aware of Xilmer's turban and the importance of the enemy not finding out what had happened, he tiptoed from the room. Hurrying to the nearest hall communicator, he inserted his key and asked his agents to make a quick search for Carr.

In ten minutes it was fairly well established that the plump psychologist was not in the Moon station. As the reports trickled in confirming this improbable fact, Wentworth put out a call to leading scientists in the station, and soon there were men and women of several nationalities standing around him, speaking into their translation microphones, giving him their concepts of the situation.

But the sum total of the scientific speculations added up to a question: What could be done by one individual to thousands?

And that, in terms of Carr's ability, came down to: What was the smallest number of lines that needed to be cut to defeat the invader?

As Wentworth stood by, glancing from face to face, it became clear that none of these trained people had any idea what the answer was.

For Carr, after he arrived on the *giyn*, there was a period of—not confusion, for he was totally aware of the problem—but of immense . . . violence.

He had—selected—an unoccupied room to arrive in; and there he was in what seemed to be a laboratory. Instruments. Tables. Machines. All these stood silently around him, unattended and unthreatening.

His problem derived from the fact that *giyn* was programmed to resist the presence of unregistered life forms. That defense system, being quiescent, had no visible lines until his appearance triggered the mechanism.

The result of that triggering created the violence.

At the instant of his appearance in the room, the walls, the ceiling and the floor focused their weapons on him. Lines of force sprang out from every side, spun a web of energy around him; tried to hold him.

And that was but the first of four progressively more destructive attack systems. The energy trap was succeeded by an elementary *mirt* discharge, designed to stun; then came a primary *mirt*, consisting of murderous impact energies; and, finally, there was a nuclear reaction

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pattern, as strong as it could be in a confined space.

To the faculty in Carr's brain, it was all signals, observed, correlated, defeated at source. Each attack was a cycle that ran its programmed measure. All cycles completed. Silence settled.

Pause.

Abruptly, somewhere aboard, a living mind took note. And an astonished voice spoke into Carr's brain:

"Who are you?"

Carr did not reply.

The immense number of signals that had been flooding in on him from other levels told him that he was inside a ship twenty miles long, five miles wide and four miles thick. There were 80,000 Gizdans aboard, each of whom now tuned in on the alarm that had alerted the entire ship.

For a few moments, they had the same general thought; the same conditioning responded, the same attention focused on the intruder. Like so many iron filings abruptly magnetized, the pulsations of alignment made a pattern. It was the pattern that made them manageable.

Carr in a single, comprehensive glance isolated the tiny portion of significant lines—and cut them.

Then, with equal unerring skill, he selected a mass of lines that inter-related and interacted with Basic Truth, drew them to him, intertwined himself with them—and stepped through an energy vacuum into the room on the Moon Station where Denovich lay asleep under sedation. He had a feeling that very little time remained for the "twist" ability.

Hastily, he repaired the lines he had cut earlier and watched the massive internal armor of the psychiatrist realign. Whereupon Dr. Carr walked out of the room, out of the hospital sector, to the nearest phone booth. He called Wentworth.

When the Security Officer finally came on the line, he said, "Doctor, what happened?"

"They've left," said Carr simply.

"B-but—" Wentworth's voice poised at a peak of puzzlement. But he caught hold of himself and said more calmly, "Doctor, we figured out here that there was probably a smallest decisive group of lines to cut—"

"That's what I did."

"But what could that be? What could be the lowest common denominator for so many persons?"

Carr told him.

Wentworth said, admiringly, "Well, I'll be . . . Of course. Congratulations, Doctor."

Hours later, when the ESP twist was already faded, at a time when the *giyn* was nearing the remote end of the solar system and still accelerating, it made its sub-space contact with the great Gizdan fleet cruising in another part of space.

"Got anything for us?" said the fleet commander.

"No!" said the captain of the *giyn*.

"We understood you were approaching an inhabited system that looked easy."

"I don't know how you could have got such an impression. There's nothing here at all."

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"Okay. Break contact."

As the captain of the *giyn* complied, for an instant he had a fleeting impression, like a dream, as if there was something he ought to know about the sun system through which the *giyn* had passed.

Had he been able to be aware of such things, he would have noticed that all lines relating to Earth and the moon were cut and coiled back into a tiny corner of his brain.

The feeling of something known and understood . . . faded. And was gone.

Forever. END

Coming . . . Tomorrow!

Few things we have published have attracted as much attention as the article by R. C. W. Ettinger. *The Prospects of Immortality,* which appeared in our second issue, some three years ago. Ettinger's idea, as you may remember, is to give ourselves eternal life — now! — by freezing every person who dies immediately after death, keeping the body unchanged until such time as medical science has achieved a point at which it can (a) repair whatever was the cause of death, (b) compensate for freezing and thawing damage and (c) start him up again.

Since then, of course, magazines like *Playboy, Esquire, Ebony, Cosmopolitan* and a great many others have carried articles by Ettinger and others on the subject, and many hours of air time have been devoted to it, on nearly every major radio and TV show on the air. We recently took part in one such discussion, and we have secured a transcript of the highlights of it. The participants are Ettinger, Long John Nebel, Dr. Joseph Lo Presti, your editor and a Danish gentlemen named Victor Borge, and we'll bring it to you next issue. . . .

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The *Willy Ley* Story

by SAM MOSKOWITZ

Here's the lowdown on Galaxy's long-time columnist — and sf's favorite science-fact writer!

When the Russians successfully rocketed into orbit the first artificial earth satellites (Sputnik I, October 4, 1957 and Sputnik II, Nov. 3, 1957) the American public in humiliation, chagrin and alarm turned from administrative sources to the leading popularizer of rocketry and space travel, Willy Ley, for an appraisal regarding the implications of these historic achievements.

They could not turn to Dwight D. Eisenhower, who on July 30, 1955 had released the headline news that the U. S. would send an earth satellite into space, in a manner that led them to believe that our preeminence in that area was beyond question, and implied that he was fully in support of the project. (After he left the presidency, he would never cease to blast the space program.) Certainly they could not respect the views of Charles E. Wilson, who as Secretary of Defense, had cynically sat on the lid of appropriations for this project.

There was a precedent for their attitude. When buzz bombs and V-2 rockets were terrorizing London and when the military jet fighter was introduced during World War II, the communications media had found Willy Ley the only voice to reliably interpret the developments to the layman in terms he could understand and in a manner in which he could gain confidence.

So completely was Willy Ley regarded as the voice of authority on the earth satellite fiasco that when Tiffany Thayer in the official

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organ of the Fortean Society, *Doubt,* (Whole Number 56, 1957) called the Sputniks "the most preposterous lie since the invention of virgin motherhood," he singled out Willy Ley as the "prophet" of this "major fraud and hoax."

Writing for the conservative weekly *National Review* (Dec. 7, 1957), Ley in *Some Implications of the Sputniki* capsuled the situation cogently and candidly when he said: "Our job is simply to catch up with the Russians. This may not be easy by any means but it can be done. But there is no way of erasing the loss of prestige we suffered. All one can hope for is that it may be overshadowed by later events." Willy Ley went on to say that the major military significance of the satellite was "in the rockets that launched them", meaning that Russia was on her way to the ICBM.

Willy Ley had gone on record as to the military implications of space many times before, most conspicuously in *Look,* July 31, 1951, in a feature illustrated by Chesley Bonestell titled *How We Could Wage a War from Man-Made Stars.* Earlier, the same year as the first sputniks, speaking at the Newark Museum, Jan. 29, 1957, Ley had said: "The Russians are probably working on their own satellites . . . they claim not to be, but have said that if they do build one, it will be 10 times larger than ours."

Television was fortunate for Willy Ley. A burly man, with broad features and black-rimmed glasses, he was dramatically visual. On the lecture platform he paced deliberately to and fro, waving a piece of chalk in one hand to illustrate his points on a blackboard. As he talked in his thick German accent, he constantly buttoned and unbuttoned his double-breasted jacket.

WILLY LEY

The secret of his appeal was reflected in his most common phrase: "There is a story behind that." Whether it was Einstein's famed equation or Werner von Braun's rocketry experiments, Willy Ley always seemed to know a hitherto untold anecdote relating the scientific facts to humanity.

Ley was born on Oct. 2, 1906 in Berlin, Germany. His father, Julius Otto Ley, was at that time a wine merchant in Konigsberg, East Prussia, and his mother, Frida

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May, was the daughter of a Lutheran sexton in Berlin. Willy Ley, through most of his childhood, saw little of *either* parent. His father had the wandering-itch. Leaving his wife and child with her parents, he traveled first to New York in 1910, eventually to open a German delicatessen in London in 1913. His wife joined him then, leaving Willy in the charge of her three sisters. When World War I broke out, she was sent back to Germany with her eight-month-old daughter, Hildegarde, while her husband was placed in a detention camp on the Isle of Man.

Working at the millinery trade in another city, she saw her children only one afternoon every two weeks. The sisters took turns at being mother to them and fortunately did very well at the task.

Willy Ley completed four years of public school and eight years of high school in Berlin. He was an excellent student, obtaining his background in Latin, French and English in high school. He had some problems with the low-income children in grade school, who believed his family was wealthy because he was well-dressed, but this was compensated for by his high school period, when he participated in such sports as soccer, tennis and *schlagball.*

Released from the British detention camp in 1919, his father returned to Germany and borrowed the funds from friends to go into the liquor business. Willy then broached the idea that the family finance his college tuition. This they greeted with mixed emotions, for he would be stepping out of his class by aspiring to an education greater than that of his father. Greatly troubled, his mother's father sought spiritual guidance from his pastor on this problem. Piously restraining his laughter, the pastor after solemnly contemplating the dilemma finally gave Willy Ley his blessing.

Willy Ley entered the University of Berlin in 1924, taking courses in paleontology, zoology, comparative anatomy, physics, astronomy and mathematics. The financing was eased by Ley's apprenticeship as a bank clerk for two and one-half years, working at the bank eight hours a day and going to school nights. The entire family ran out of money in 1927 and he briefly enrolled at the University of Konigsberg, the town in which his father's business was located. The continuing economic decline of Germany found Willy Ley forced to leave college after three years for lack of tuition.

Willy Ley had gained some affinity to science fiction in his high school reading of Jules Verne, H. G. Wells, Edgar Allen Poe, Kurd Lasswitz and Maurice Renard, but the real "moment of truth" arrived when he saw a copy of *Die Rakete zu den Planetenraumen* (*By Rocket into Planetary Space*) by Hermann Oberth in a Berlin bookshop in 1925. It was the second edition of that seminal work (originally published in 1923) and contained in its concluding chapter a reference to the feasibility of artificial earth

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satellites. Ley was enthralled and dispatched a letter of enthusiastic approval to the author.

Oberth's book had previously inspired Max Valier, a popular science writer and former officer in the Austro-Hungarian air force, to make rocketry his life. His first step was to attempt a popularization of Oberth's book, which appeared in 1924 as *Der Vorstosos in den Weltenraum* (*Advance into Space*), selling through five editions to be completely revised and almost tripled in content as *Raketenfahrt* (*Travel by Rocket*) in 1930.

Willy Ley was not impressed. Reading Valier's book, he felt it was obtuse, flippant and unnecessarily cluttered with mathematics. He was certain he could do better, so though only 20, with sublime confidence he penned *Die Fahrt ins Weltall* (*A Trip Into Space.*)

Amazingly it sold. He got an advance of $110 from Hachmeister & Thal, Leipzig, who published it in 1926 as a 64-page paperback priced at the equivalent of 30c. In the process of explaining Oberth to the layman, Ley drew his own diagrams and spaceships to illustrate the book. It eventually sold 9,000 copies, but more important, it established Ley internationally as a serious student of rocketry. Eventually as distinguished a scholar as Prof. Nikolai A. Rynin, author of the nine-volume set on space travel published in Russia, *Interplanetary Communications,* (Leningrad, 1928-1932) would write Ley for his photo and autograph.

More immediate, Max Valier, on a lecture tour, stopped off in Berlin to visit Ley. Here he told him about plans for the organization of a German rocket society. This was formed June 5, 1927 in Breslau, Germany and was registered under the name of *Verein fur Raumschiffahrt* (Society for Space Travel). President of the society was Johannes Winkler, who was also editor of the club organ *Die Rakete* (*The Rocket*), which would be published monthly until Dec., 1929. Willy Ley would edit the last few issues of the publication, after ascending to vice presidency of the Society in 1929.

Within a year the Society boasted a formidable membership of almost 500, including nearly every European rocket man of note. Among them were Hermann Oberth and Walter Hohmann of Germany; Guido von Pirquet of Austria; Professor Nikolai A. Rynin of Russia; and Robert Esnault-Pelterie of France. Eventually it would boast a substantial membership from the United States including Hugo Gernsback, G. Edward Pendray, David Lasser, C. P. Mason, F. B. Eason and R. F. Starzl.

Ley convinced his distinguished membership that the best way to further the ends of the society was for qualified men to write articles on designated phases of space travel, to be collected into a volume titled *Die Moglichkeit der Weltramfahrt* (*The Possibility of Space Travel*). Edited and with a contribution by Willy Ley, it was an impressive

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volume, selling for $4.50, with essays by Hermann Oberth, Walter Hohmann, Baron von Pirquet, Friedrich Wilhelm Sander, Franz von Hoefft and even an article on the science fiction in the German language by Karl Debus.

It caught the eye and imagination of Fritz Lang, the famed German moving picture producer of *Metropolis,* a Ufa production released in early 1927 which depicted the workers as slaves of the machine in a nightmarish world of tomorrow. A sequence in the shooting script of *Metropolis* was to have shown a celebration upon the return of a spaceship from Mars. After much soul-searching, Lang had discarded it as out of place. Now he felt the scene could be used as the basis for a new film, *The Girl in the Moon,* made believable by the scientific principles expressed in Oberth's book and *The Possibility of Space Travel.*

Hermann Oberth was called to Berlin as a consultant. Given four months to design a working rocket that would ascend to 45 miles, in time for the picture's premiere, he almost blew himself up and ended by literally fleeing back to his rural home in Transylvania before completion of the project. Nevertheless, the models designed by Oberth and the space technology of *The Girl in the Moon* as released by Ufa in 1929 were the memorable parts of an otherwise sophomoric film. The "girl" in the moon — the film's star, Hungarian actress Gerda Maurus — became so intrigued by the subject that she joined The Society for Space Travel. Willy Ley was paid to write 12 articles, stressing the scientific validity of the film, given free as press releases to newspapers.

At the same time, Max Valier, with the assistance of a German automobile manufacturer, Fritz von Opel, was stealing the play from the film by piloting cars and ice sleds powered with powder rockets. Ley blamed this emphasis on powder rockets for also hurting the sale of his anthology which propagandized for the use of liquid fuels and thought was seriously given to expelling Valier from the Society. Valier would eventually die, a martyr to those same liquid fuels, in an explosion resulting from rocket experiments conducted with liquid oxygen on May 17, 1930.

After *The Girl in the Moon* disappointment, The Society for Space Travel dropped its official organ, *The Rocket,* to utilize those funds for a controlled series of experiments in the actual construction and firing of rockets on its own. It was Ley's good fortune to participate in and obtain records of the entire series of those tests through to early 1934, giving him an "I was there" credential on rocket history.

The year 1928 saw a boom in space travel interest in Germany. That year Willy Ley also included Hachmeister and Thal to publish *Mars, Der Kriegstplanet* (*Mars, Planet of War*) a slim paperback about that neighboring body.

Several others saw the commer-

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cial possibilities in the interest in rocketry. Otto Willi Gail, a writer of juvenile fiction and non-fiction, had published a teenage book on space travel titled *Mit Raketenkraft ins Weltenall* (*With Rocket Power into Space*) in 1928. He followed this with three volumes of science fiction *the same year*: *Hans Hardts Mondfahrt* (*Hans Hardt's Moon Trip*), a juvenile novel of a rocket flight to the moon (reprinted by The Sears Publishing Co., New York, 1931, as *By Rocket to the Moon*); *Der Schuss ins All* (*The Flight into Eternity*) and *Der Stein vom Mond* (*The Stone from the Moon*). These three science-fiction novels were, in their way, historic milestones in science fiction, because they scrupulously followed the theories of Hermann Oberth's book in their presentation of space themes. There were multi-stage rockets, earth satellites, precise descriptions of life in a spaceship and survival in the void.

Especially noteworthy was a book by Capt. Hermann Noordung, *Das Problem der Befahrung des Weltraums* (*The Problems of Interplanetary Flight*), Berlin, 1928. In minute detail, Noordung (pen name for Austrian Capt. Potocnik) described every facet of space conditions, with the bulk of the book taken up with material on the construction and operation of a space station. His work, though derived from Oberth, can be described as nothing short of brilliant. There is no question that "Noordung" immensely added to and enhanced what he borrowed.

In the United States, another very remarkable man, Hugo Gernsback, was investigating foreign sources for possible reprints for the new science fiction magazines he was projecting. SCIENCE WONDER STORIES, SCIENCE WONDER QUARTERLY and AIR WONDER STORIES. Born in Luxembourg, he read both German and French easily and recognized instantly the value of Noordung's work, which he had translated by Francis M. Currier, and published in three parts in SCIENCE WONDER STORIES, beginning with its July, 1929 issue. Of historic importance is Frank R. Paul's cover on the August, 1929 issue of that magazine, which is believed to be the first color interpretation of an earth satellite in the history of the world.

He also bought American rights to both of Otto Willi Gail's adult space novels and translated *The Shot into Eternity* as *The Shot into Infinity*, running it complete in the first — Fall, 1929 — issue of SCIENCE WONDER QUARTERLY. *The Stone from the Moon* he ran complete in the Spring, 1930 issue of SCIENCE WONDER STORIES. These stories, together with Noordung's book, form the basic science framework of the bulk of American and British space fiction that has been written since.

R. F. Starzl, of LeMars, Iowa, a science-fiction writer contributing to Gernsback's magazines, was also a member of the German Society for Space Travel. He sent the first issue of SCIENCE WONDER

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QUARTERLY to Willy Ley because of the Otto Willi Gail translation. This was Ley's first encounter with a science-fiction magazine and ranked with the finding of Oberth's book in opening an incredible world of intellectual stimulation. The Gail translation interested him not at all, for he had read it in the original, but he would never forget the thrill of "devouring" a novel by Edmond Hamilton, *The Hidden World,* in the same issue. Hamilton had come up with a new theory for the possible existence of a hollow earth, peopled with a strange race of advanced technology, who traveled on flying saucers. Ley was from that instant hopelessly hooked.

Starzl also led Willy Ley into science-fiction fandom. The International Scientific Association, whose secretary was P. Schuyler Miller, ran in its publication COSMOLOGY (July-Aug., 1931), edited by Aubrey MacDermott out of Oakland, Calif., what was probably Willy Ley's first deliberate contribution to an American magazine (material may have been translated and printed previously without his knowledge), *Space-Flying and Rocket-Traveling,* running for two installments concluding in the Jan.-Feb., 1932 issue. Whatever the reason, the article, a light review of the title subjects, was printed unedited, with inverted phrases, mispellings, misusages of grammar and punctuation retained as submitted; nor was an announced third installment run.

Willy Ley was made an honorary member of The International Scientific Association and listed as "German Director" on the cover of the March-April, 1932 issue of COSMOLOGY. This was changed to "Director of Rocketry" with the final, Vol. 6 No. 1 issue of COSMOLOGY, dated merely "1933," to which he contributed several articles (including one in which he proudly announced that the son of the Reichminister Freiherr von Braun, Werner von Braun, was a member of the German society). His English, nevertheless, still remained editorially sancrosanct.

The example of the German rocket group was emulated in the United States by Hugo Gernsback's editor, David Lasser, who formed The American Interplanetary Society on March 21, 1930 in New York. He recruited members from his contributors and other editors of his publications, among them C. P. Mason, G. Edward Pendray (Gawain Edwards), Nat Schachner, Laurance Manning, William Lemkin and Fletcher Pratt. David Lasser wrote *The Conquest of Space,* the first popular book on space in English (Penguin Press, N.Y., 1931). He also edited the Society's organ, THE BULLETIN OF THE AMERICAN INTERPLANETARY SOCIETY, which began printing bulletins about the German group, based on letters from Willy Ley to G. Edward Pendray, with its second issue, July, 1930. Willy Ley would eventually become a signed contributor, first appearing after the BULLETIN had changed its name to ASTRONAUTICS, with *The Why of Liquid Propellants for Rockets,* in its Aug.-Sept., 1932 issue.

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A fan letter from Willy Ley to the "Reader Speaks" column of WONDER STORIES, Jan., 1931, expressed his growing interest and involvement in United States science fiction as well as rocketry. This made him the natural person to visit when G. Edward Pendray of The American Interplanetary Society (then the science editor on THE LITERARY DIGEST) arrived in Germany with his wife in April, 1931. He gave the impression that the prime purpose of the trip was to visit the German rocket experimenters and he was given not only a rocket demonstration by the Society, but complete technical information on all their experiments. Having collected this data, Pendray then published it in extensive detail in THE BULLETIN OF THE AMERICAN INTERPLANETARY SOCIETY. The American group, using the German findings as background, was then able to start conducting its own experiments in the field of rocketry.

The formation of The British Interplanetary Society in Liverpool, England, with P. E. Cleator as president (Cleater would later produce the book ROCKETS THROUGH SPACE, George Allen & Unwin, London, 1936), elicited an article *Rocketry in Germany* by Willy Ley, which appeared in the second, April, 1934 number, of THE JOURNAL OF THE BRITISH INTERPLANETARY SOCIETY.

Unwittingly, Willy Ley was setting the stage for what was to be the most dramatic decision of his life.

The National Socialist party and Adolf Hitler were moving into power in Germany. Rudolf Nebel, a member of The Society for Space Travel, (a man originally hired by Hermann Oberth as a technician on his ill-fated *Girl in the Moon* rocket), in late 1932 went to government officials and told them about the rocket experiments in an attempt to gain favor. The result was the immediate involvement of the rocket society, and when the Nazis came into power in 1933, their agents were swiftly on hand to supervise affairs.

President of The Society for Space Travel was Major Hans-Wolff von Dichuth-Harrach, the son of a commanding general of World War I and by profession an air flight instructor. He called the men of the Association to his home, including Willy Ley, and told them forthrightly what the implications of the Nazi assumption of power meant.

Following his lead, Ley resigned from The Society for Space Travel. The Gestapo seized all records and equipment of the Society; and Willy Ley, on advice of Major Dichuth-Harrach, decided to leave.

Professionally, things had slowed down for him. A final brochure of 16 pages, titled *Synopsis of the History of Rockets,* was published privately in 1931 and sold by direct mail. His last paying book was a biography of "the father of geology," *Konrad Gesner,* published in 1929. He made his living working as office manager and account keeper for a firm selling I-beams and wire.

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Ley had met American students studying in Germany, and gained from them information on immigration laws. He obtained an American visitor's visa from the U.S. Counsel. He carried a letter on his company's stationery (which he had typed himself) saying that he was on a vacation to England and would return on Jan. 27, 1935. He took the last train out of Germany on Jan. 7, 1935. The border guard, tired from a long day of inspection, gave his papers only the most cursory check.

His father had advised him how to get around in London. From there he traveled to P. E. Cleator, the President of the British Interplanetary Society, in Liverpool. He stayed with Cleator for two weeks when the liner he had booked to the U.S. canceled its trip. To help him out, Dr. A. M. Low, editor of ARMCHAIR SCIENCE, paid him $16 for an article on rocketry. He finally arrived in America Feb. 15, 1935 on an Olympic-Cunard vessel.

He made his way to the home of G. Edward Pendray in Crestwood, Westchester County. Pendray put him up for nearly five weeks, until he arranged with Peter van Dresser, a member of The American Interplanetary Society and later a contributor of juvenile science fiction to AMERICAN BOY, to rent him a room on Bank Street in New York's Greenwich Village.

As a visitor, he could not take a regular job in the United States. Pendray secured him an assignment for $25 with a publisher to read and report on a book in German on the Hapsburg Princes. He turned to writing, desperately polishing his English into professional proficiency. His first sale was a translation from the French of an article on the sex life of a sea horse to NATURAL HISTORY, official publication of the Museum of Natural History in New York. A piece on high altitude research rockets sold to McGraw Hill's AVIATION, while SPORTSMAN PILOT took an article on takeoff rockets. Sales were also made to French and Swiss aviation publications.

Precariously he managed, averaging about $12 per week during 1935 and 1936.

Among his few luxuries were the science-fiction magazines. He found himself particularly enchanted with the works of E. E. Smith, Stanley G. Weinbaum, Raymond Z. Gallun and P. Schuyler Miller. Late in 1936, on an impulse, he decided to try his hand at a science-fiction story.

The result was a short novel about an American hired to exterminate the deadly centipede-like *tchorts* from the Russian zone of Mars, who gets mixed up in a power play and squeaks back to earth through use of a tricky space orbit. The story showed the influence of Stanley G. Weinbaum, contained machines called Oberths, and the here writer-scientist was a thinly disguised Willy Ley who prophetically meets and marries a Russian girl!

The story was sent to ASTOUNDING STORIES, then edited by F. Orlin Tremaine. A letter from Tremaine said that he liked the story and would

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use it (ASTOUNDING STORIES, Feb., 1937) as *At The Perihelion* — Tremaine's title — under the pen name of Robert Willey, but that he was familiar with Ley's reputation and would like a serious article on rockets. Tremaine had been trying to raise the tone of his magazine, eliminating the reader's department in favor of one called *Science Discussions*. The result was *The Dawn of the Conquest of Space* (ASTOUNDING STORIES, March, 1937), a very elementary discussion of rocketry.

At almost the same time, Ley mailed, on speculation, an article titled *Eight Days in the History of Rocketry* to THRILLING WONDER STORIES. The editor, Mort Weisinger, not only was thoroughly familiar with Ley's role in rocketry, but had just published *Spaceward* by P. E. Cleator in the Aug., 1937 issue of THRILLING WONDER STORIES. Ley received a check, his article was published in the Dec., 1937 issue, and Leo Margulies, editorial director of the magazine, sent for him and arranged for more. Weisinger billed Ley as "The World's Foremost Rocketry Authority." Robert Goddard might have legitimately protested, but, true to his customary reticence, nothing was heard from him.

Having sold Tremaine a half-dozen pieces, Ley thought he would try another tack; an article on zoology. *Living Fossils* went off to ASTOUNDING SCIENCE-FICTION, but it was returned by a man named John W. Campbell, who said he was now handling all editorial matter and wanted a revise. The article appeared as *Witnesses of the Past* (ASTOUNDING SCIENCE - FICTION, June, 1938), dealing with the various creatures of Africa, Australia and New Zealand which should be extinct but weren't. It scored a big hit and Campbell would buy, over the next decade, scores of articles on space, zoology and missiles, and even several more pieces of fiction, all of which would provide the stepping stones of a climb to a world-wide reputation.

A resident of Long Island City, in response to an invitation, Ley showed up at the meeting of the Queens Science Fiction League of the same city, Jan. 8, 1939, appropriately held at Bohemian Hall. He gave a talk based on his article *Ice Age Ahead?* scheduled for ASTOUNDING SCIENCE-FICTION, March, 1939. Soon after that, his serious article *Are Rocket Airplanes Possible?* appeared in the July, 1939 issue of the science fiction fan magazine NEW FANDOM.

He wound up delivering the after-dinner speech at the banquet of The First World Science Fiction Convention, New York, July 3, 1939, in response to a request by Frank R. Paul, in whose honor the dinner was held. Ley appropriately discoursed on his methodology for converting scientists to science-fiction readers. Willy Ley would remain involved with the science-fiction fan movement the rest of his life, gaining not only friendship, but actual valuable business contacts and promotional publicity from his connections.

To make it possible to obtain a regular job, Willy Ley, utilizing

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the money from his early science-fiction magazine sales, set up residence in Havana, Cuba in Feb., 1937 and then emigrated to Florida in March. The opportunity for a job did not present itself until 1940, when Ralph Ingersoll obtained financing to turn out a New York evening tabloid called PM. The intent was to be virtually a daily LIFE magazine, accepting no advertising and subsisting on the 10c price at a time when many of its competitors sold for three cents.

Tom Davin, the production man of NATURAL HISTORY (to which Willy Ley continued to sell) was offered a job running the "Coming Events" operation for PM. He hired Ley to keep tabs on the scientific and military proceedings for him. After one year, an efficiency expert evaluated the staff of five and fired every one but Willy Ley, who continued as a columnist at a better salary.

It was at PM, in 1941, that he met Olga Feldman, a woman who had come to America as a child when her parents fled from communist Russia. As a girl, she had danced in a ballet troupe of Russian ex-Czarists and then had conducted women's exercises in a beauty salon for seven years. PM hired her as a physical culture columnist when she approached them with anecdotes of her experiences in the salon. Willy proposed with the phrase "I want you for Christmas!" so they were married Dec. 24, 1941. Two children were born from the union: Sandra, March 11, 1944, and Xenia, April 11, 1947.

While still with PM in 1941, Tom Davin had submitted a book on economics for a friend to Modern Age, a book publishing firm organized by the owner of Child's restaurants. It had been rejected. He tossed the rejection, which read: "For God's sake! Not another book on economics," on Willy's desk. Willy bundled up some of his zoological articles from NATURAL HISTORY and ASTOUNDING SCIENCE FICTION and obtained an interview.

The result was *The Lungfish and the Unicorn,* issued in 1941 (later reissued as *The Lungfish, the Dodo and the Unicorn* by Viking in 1948). This was followed by *Bombs and Bombing,* educating the civilian to understand what might be dropped on him during war time and what to do about it. Interest was lively; the book, going into a second edition almost immediately, was then followed by *Shells and Shooting* (1942) which did not do quite as well, having less of an immediacy for the home public.

Drafted into war, Modern Age's owner permitted his authors' contracts to be sold to Viking Press, and disbanded the company. Editor of Viking was Pascal Covici, former part-owner of Covici-Friede, renowned Chicago book firm of the twenties. He vetoed the idea of another book on romantic zoology for Willy Ley but approved the notion of a book on rocketry and space travel, which war developments were bringing into focus. This appeared as *Rockets, the Future of Travel Beyond the Stratosphere,* in 1944, barely gaining the jump on *The Coming*

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Age of Rocket Power by G. Edward Pendray, issued by Harper's early in 1945. Both books went into second editions within a year and for a while the battle was joined as to whether Willy Ley or his old friend G. Edward Pendray would emerge as "the leading authority on rocketry."

At a time when almost the entire "history" of rocketry still lay in the future, Willy Ley gained the edge by his knowledge of the past. Pendray showed competence both in science and writing, but Willy Ley "knew a story about that development." Six revisions and 18 printings later, *Rockets, Missiles and Space Travel* had passed 85,000 in sales and a new revision was in process.

The furore over the German buzz-bombs and later the V-2's and the willingness of Willy Ley to permit himself to be exploited for the sake of promoting his book *Rockets* catapaulted him into the limelight during 1944 and 1945. The most unusual result of this publicity was the offer of a job on the development of a rocket which could send meteorological instruments to a height of 100,000 feet and which would be so simple that anyone could be taught to operate it.

The attainment of this objective had been one of the goals of the early rocket pioneers, so Willy Ley jumped at the chance, moving his family from New York to Atlanta in October, 1944. After eight months his firm was absorbed by another in Washington, D.C. and Ley shifted his family there to continue with the experiments. The project petered out in the Fall of 1947 when it became obvious that the proliferation of air travel would make promiscuous use of meteorological rockets impractical.

At the same time that Willy Ley was scoring with his rocket book, the wife of Chesley Bonestell, an artist in the special effects department of Warner Bros. and a master of simulating photographic realism in combination with miniature models, submitted a group of color "closeups" of the planet Saturn and its rings to LIFE. The publication of six of them in full color in the May 29, 1944 issue created a new reputation for the aging artist. Among those most impressed was the editor of MECHANIX ILLUSTRATED who bought reproduction rights to 10 astronomicals arranged in a sequence under the title of *Rocket to the Moon*, printed in full color in its September, 1945 issue with the text by Willy Ley.

With 65 of his superb space "portraits," most of which had already appeared in LIFE, MECHANIX ILLUSTRATED, CORONET, SCIENTIFIC AMERICAN, PIC,, AIR TRAILS AND SCIENCE FRONTIERS and ASTOUNDING SCIENCE FICTION, Bonstell set out for New York. He invited Willy Ley to lunch at the Barbizon-Plaza and asked for his advice on how to go about arranging for portfolio publication of his paintings. Ley introduced him to Pascal Covici of Viking, who wasn't the least bit interested in speculating on a portfolio but was willing to gamble on the

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paintings as the basis of a book, if Willy Ley would write the text.

The collaboration appeared as *The Conquest of Space* in 1949 and the color reproduction was by far the finest that Bonestell's work had ever received. Because of the expensive color plates, the publishers doubted that the book would make money and Bonestell and Ley received only a nominal advance with a contract that gave them no further royalties unless the book sold over 20,000 copies. It soared to 84,000, proving not only a professional but a financial success for its creators. Quite deservedly it won The International Fantasy Award for non-fiction in 1951. (*Dragons and Amber,* a zoological volume by Willy Ley would take second place in 1952).

Willy Ley's stock soared, too. Everywhere one turned Willy Ley's name was on a book, in a magazine, in the newspapers or on a catalog endorsing a rocket toy. His face peered out from the television screen; his voice, instantly identifiable, seemed always on radio; and posters announced his lectures at major cities across the country.

At one point he got so busy that L. Sprague de Camp had to finish a book on imaginary lands of human legend he had begun, *Lands Beyond* (Rinehart, 1952) and it promptly won The International Fantasy Award for the best book of non-fiction in 1953. He received $2,000 a trip to fly to the Walt Disney Studios one week each month for a year (1953 — 1954) to act as a consultant for space sequences in films.

Through all this, he remained constantly an integral part of the science fiction scene, identified with GALAXY SCIENCE FICTION, under exclusive contract to produce a department *For Your Information* every issue. This "department" usually led off with a feature article, with subject titles like *When Will Worlds Collide?, The Cause of the Ice Age, Ancestor of the Dinosaurs, Living in a Space Station, Is Artificial Life Possible?, Tracking Down the Sea Serpent* and *The Other Side of the Moon* revealing their intriguing content. Ever since the department's inception in March, 1952, these articles have remained uncollected. This is to be remedied shortly when Doubleday will issue a selection of them in book form.

So great was Willy Ley's popularity in science-fiction circles that he was selected as guest of honor of The 11th World Science Fiction Convention, held in Philadelphia, Sept. 5-7, 1953, the only non-fiction writer ever accorded this distinction.

His unique talent is nowhere better displayed than in *Watchers of the Sky* (1964), which not only comes close to being the definitive modern text on astronomy but is by all odds the most fascinating. It will soon be followed by *A History of Zoology* from Prentice Hall. No two volumes could more appropriately epitomize the major facets of Willy Ley's appeal the scientific mind that has always gazed with disciplined wonder at the marvels of the stars but whose humanity never fails to thrill at the miracle of the diverse creatures of the earth. END

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SPY RAMPANT ON BROWN SHIELD

by PERRY VREELAND

Illustrated by Morrow

The cloak was marvelous. It made a man invisible most of the time . . . and then when it failed, it killed him dead!

I

Joshua looked down at where his feet should be and experienced again the sensation of slight vertigo. Funny, you felt on the point of falling all the time.

He wrenched his eyes away and up, and told himself to concentrate only on kinetic sensations, body responses, the solid feel of the sidewalk under his soles, the flexing of his thigh muscles as he walked. He found himself swishing his hands against his sides. It was a bad habit to get into under the circumstances,

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but hard to avoid because the Cloak ballooned out a little around the thighs. And naturally there were no pockets—except the pouch in front, which was filled anyway.

The only place to rest the hands was on the belt itself. He hooked his thumbs on it only after assuring himself by a glance that the switch was still off; which was plain silly, really, since even if it were on, mere physical strain on it wouldn't make any difference. "You're getting the jitters again, Mr. Brock," he told himself, as an objective observer. "You always get the jitters on a job. Since you're such a goddam coward, what the hell are you doing in a racket like this?"

But still, there *ought* to be pockets. They could have been wired in, too. He'd have to take this point up with the Boss . . . when he got back.

It would be nice to be back, back in that office in Washington, reporting that things had gone smoothly.

He had been in that office only twenty-four hours ago. At eight in the evening the Boss had phoned:

"Glad I found you home, Josh. Something's come up. Mind hopping over to my office right away? Not the department; the one in Old Washington."

"*Mind*? I sure do," said Josh as belligerently as he could manage from a standing start. "I'm glad you want to know if I mind. I haven't had two weeks off in one piece since 1989, Walter."

"Listen, Josh, I *am* sorry, but it's business."

He recognized the tone. A stomach muscle flipped over and he swallowed to straighten it out. "Right," he said, and had to be flippant: "'The USNA Needs You.' Okay, I'm leaving this instant."

"Wait—on second thought, I'll pick you up. You've got ten minutes to pack a bag. Meet me on your copter deck."

In the car Walter began without any preliminaries even before reaching the thousand-foot lane. "Up to this I was going to give you another week, Josh. Honest I was. But this comes direct from Sam Luther. Luther himself. Half-hour ago, he phoned and said: 'This is the five-alarm emergency and get over here with the best man you've got.'"

Josh closed one eye and cocked the other at his boss. "And that's me?"

"Since flattery won't get me anywhere, frankly I thought of Barney first, just because he's been around longer. But Barney was eliminated, so here you are."

"What eliminated Barney?"

"I'd better tell you what I know of the background of this—"

"What did Luther say that eliminated Barney, Walter?"

Walter sighed, grasped his arm and shook him affectionately. "You'd think," he began, "after nine brilliant jobs—"

"No butter, Walter. I'm just curious."

"His exact words, if I remember rightly, were: 'And I don't want any of your bull-headed lion-hearted types. We need a man with a careful kind of desperate courage."

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Josh laughed. "Fifteen years in politics and he still talks like an egghead."

"Only in private," said Walter apologetically. "But he is without a doubt the finest Executive Manager this country has had since Berenson."

"Okay," whispered Josh. "So I'm your best man with a careful kind of desperate courage."

So there he was, walking down the Avenida de las Americas in the middle of La Paz itself, at the center of the Brown empire, at half-past two in the dead of night, with a good three-hour trek ahead before he'd reach La Ciudadela and its square mile of government buildings. That part of it was all right: there was no hurry now, just as long as he arrived at the Science building before dawn.

The avenue was deserted, being primarily a man-made canyon of swank shops and office buildings. Every now and then, a prowl car went by. Even before his ears were conscious of hearing the sound in the distance, his hand would be turning on the belt switch. Turning it off, as soon as the police were definitely out of sight, was a good deal less automatic.

More bothersome than the police cars was the attention required to keep an eye out for possible puddles of water. It had rained late in the evening and the streets were still wet. Step into just one puddle and he'd have to change the socks. Only four pairs had been fabricated; true, he had all four with him, helping to jam up the pouch, but he had no idea how many he'd need before he was through.

More than that, he told himself, there might be other pitfalls, unsuspected ones, apart from the obviously disastrous possibility of more rain. He forced himself to a slow pace, a painstaking examination of the sidewalk ahead as he moved forward. He couldn't even afford to stumble and bark a shin—he didn't know whether the stuff was tough enough to take it, in spite of what they said. Anyway, there was plenty of time. *A careful kind of desperate courage.*

High in the middle distance, to right and left and ahead, the Andes lifted their encircling walls and peaks. The city was a natural fortress, the mountains a natural stockade. Right now, of course, in the continuous chain of emplacements that ringed the heights around the capital, brown-clad soldiers were on the alert, with three men watching each screen. Suppose in addition there were a dome, as Sam Luther had said . . .

II

The impact of Sam Luther's celebrated personality at close range was as overpowering as Josh had expected, judging by the meetings where he'd seen him only at a distance. It was due to two things: sheer vitality, flowing from a giant frame six and a half feet high; and sheer exoticism, flowing from a jet-black skin color which now was almost extinct. *The lion type,* Josh

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thought. He ignored the coffee that had been placed on the desk before the three of them and reached instead for the brandy bottle on the side-bar.

"The National Security Council," Luther was saying, "met on this for four hours. I called you—" he turned toward Walter but still somehow managed to keep his eyes on Josh— "as soon as the decision was voted. You know something of the situation but I'd better go back to the beginning for Mr. Brock.

"It began a week ago with a message from Pizarro." He turned all the way to Josh with a smile. "That's a code name, of course, Mr. Brock. You see how deeply you are in this now when I tell you who Pizarro is, as I must. He is the highest placed man we have in the governing circles of the U.A.R., high enough to have access to one of the five most powerful figures in the Santos regime. You'll get more about him later.

"Pizarro reported that according to a report circulating on his level, it seemed that the Science Ministry in La Paz had achieved a great breakthrough. He didn't know its exact nature, but it was likely in the field of defense. The people in charge, he heard, considered it the biggest thing since the nuclear bomb; bigger than anything else effected in the last century. Now there's a good chance that this was only puff, put out by the bigwigs to boost morale. On the other hand, from some hints he ventured the guess that it might be—anti-nuclear armor of some kind."

Josh whistled, then looked confused. "What exactly would that mean, sir?"

"I'm afraid we wouldn't know exactly," said Luther grimly. "Anyway, the situation was clarified yesterday by a second message from Pizarro." He paused to sip the coffee as if to gather strength for the telling. "It's worse than mere speculation about armor. The device is called El Escudo."

"The Shield? You think that means—"

"The name alone wouldn't be enough. *Escudo* doesn't necessarily mean only shield, especially in Bolivian urban usage. It could be *sheath,* for example. But along with some other details from Pizarro there was one other hard piece of evidence. Sciacca—he's the minister of Science; oh, but you know the top men—Sciacca is supposed to have been overheard in a conversation with Perez in which he used the words: *I hit it and did I bounce!* This apparently was a snatch of conversation reported to Pizarro's patron, who of course mentioned it to Pizarro to show how close he was to the top. You know how these cutthroats operate, especially on the top level. Everybody's spying on the top level. Everybody's spying on everybody else, and no one trusts a soul. That's true in La Paz even more than in Buenos Aires. Probably there is less than a fistful of men who are supposed to know anything about it, but it's seeped down to another dozen or so—fortunately."

"So they've got a force shield,"

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mused Josh. "Actually working, do you think?"

"Yes and no. We gather that right now they've just got a working model. But let's face it." Luther shifted his chair back and made a gesture of dismissal. "It hardly makes any difference whether they're at that stage or whether they've already got a practical dome. The important thing is, it looks as if they're so far ahead they're out of sight. I'd better tell you that our men have been working on the problem of a force shield for the last ten years—*and have gotten nowhere.* Absolutely nowhere! Oh, there are some equations around. And everybody agrees it's theoretically possible. As a matter of fact, the elastic effect hinted by the information also seems to have been anticipated, according to Cotten. He doesn't mind admitting that he's flabbergasted. There must be a genius in La Paz we don't know about, he says. Poor Phil! He keeps groaning, 'how did they do it? How did they do it?' By the way, he'll be here in a half-hour and you can find out from him anything else you want to know about the state of our own work.

"But let's put into words what we're thinking.

"This may be it, gentlemen. We've been racing to get the edge in bombing power, satellite power, laser power; but everybody's known for a hundred years that a one-sided preponderance of power is no longer possible. The last time it was anything like a reality was the passing instant when we had the atom bomb to ourselves. And that was an illusion. Everybody knows, too, that one-sided total defense against nuclear power spells preponderance just as surely as one-sided possession of the bomb did. It may be that what we heard yesterday is that the North is through, *kaput.*" He pulled his lips back as if sucking on a lemon. "Maybe we ought to apply right now for admission as the *Provincia Norteamericana* of the United American Republic, by grace of the Caudillo, Cristoforo Santos."

That was shock treatment, Josh knew, but essentially there was no exaggeration. If the brown empire could actually put force shields over at least their main administrative and industrial centers, from the Guatemalan province down to Terra del Fuego . . .

Luther opened a drawer and pulled out a folder emblazoned "NATIONAL SECURITY COUNCIL, UNITED STATES OF AMERICA, SECRET," with the familiar conventionalization of the continent's outline and the seal. He ruffled its pages, as if to remind himself.

"Well, as a matter of fact we've worked out a few lines of reaction, but they're all vague. Except one. That's what the Council debated today. Three-quarters of them were against it at the beginning, and a third were still against it in the final vote, even after certain changes which will interest Mr. Brock. You see, Mr. Brock, we decided to send a man down to La Paz to get the Shield, or its plans, or both."

Paradoxically, Josh relaxed. He realized that his body had been

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tensed for this moment since he'd sat down. Since something seemed to be expected, he remarked, "When I ask Santos for it, should I offer to pay in dollars?" In the same spirit, Luther did not bother to smile but went on:

"We have our own ace-in-the-hole, Mr. Brock. Or do you play chess? In comparison with the force shield it may be only a pawn, perhaps a knight, but we may be able to use it to take their queen."

If it was a chess game, Josh thought, he was only on the first square. Perhaps he should feel like a knight, very errant. Certainly there was a castle of a sort ahead. The king to be checkmated was at his party headquarters in Buenos Aires, not here in La Paz, which was only the government center. The queen to be taken was on the last square.

Before the chess analogy got labored any further in his mind, the growing rumble of noises ahead and the accompanying glow of light broke it off.

He was approaching Calle Catorce de Mayo, the main intersection that lay between him and his destination; that is, the only intersection of his course which would have people and lights around at three o'clock in the morning. It was a rundown business street and tenderloin district combined; there was an all-night cinema, a couple of bars which never closed. Besides people, there would be policemen around. Well, they could be ignored. Worst of all, the merchants left lights burning in their closed stores and in the windows.

Lights! Death rays, for him. And in Washington they hadn't even been able to tell him how to avoid a shimmer—not really they hadn't, just some general advice.

His hand would turn the belt switch on in another hundred steps. Though he knew the Andean night air was chill, he felt a trickle under his armpits.

"You're a yellow bastard, Mr. Brock," he told the demon that sweated. "You're a disgusting sniveler." That cowering thing somewhere down in his guts had to be kept under, had to be throttled, with a hand tight on its throat. That was it—tight on the throat.

He eased into a doorway near the corner, disregarding the brown-clad cop standing a dozen feet away, and surveyed the lights. There was that bar: open, across the street, but only a dim glow from its windows. Probably not a real danger. There was a street lamp further down to the left. To the right there was another, but about twice as far and on the opposite side of the street. To be sure, he took out his photometer.

The readings were reassuringly different, of course, but what did that prove? For example, how about that semi-lit cinema marquee which was also down to the right. Did it change things? Should its light be taken as adding to the far street lamp or was it too different an angle? Suppose a car suddenly came down the street and shot its headlights at him? On second thought, the real danger was that a second car might be coming down the other street at the same time . . .

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To hell with it, he was just wasting time with all this jittering. The big safety factor, Cotten had emphasized, was the low-intensity differential. There wasn't much danger here. There wouldn't be much danger till dawn. As he walked by the indistinct brownness of the policeman, he rehearsed some of the figures that Cotten had reeled off.

III

Phil Cotten came in with a cup of coffee in one hand and a rectangular metal box in the other. He was ridiculously short, round-faced and tubby, but he was a good man.

"I left the men downstairs," he told Luther. "Hi, Walter."

Walter flipped a finger and said, "Joshua Brock." Josh shook hands silently. Luther said, "I want you to go through your end of it, Phil, before I tell him about the Council decisions. He's got the U.A.R. story and a few generalities."

Cotten set the box on the desk, fished a key out of his pocket and opened the lid. Reaching in with both hands, he pulled them out like a tailor holding a dress up to the light. Because of his shortness, he held his hands up over his head to keep the thing in his hands from dragging on the floor.

Only there was no dress in his hands. There was—nothing.

The other three leaned forward as one, with an intently concentrated gaze focused in space. Luther got up and walked around to the side. "You know," he muttered, "this is only the second time I've seen it

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myself. Or —" he amended — "not — seen it myself."

Cotten laid it over the desk with a sweep of one arm, sat himself on another corner of the desk, and addressed Josh. "Feel it," he said, with an expansive gesture. Josh reached out, groped and touched it gingerly.

"Go ahead, take a fistful," Cotten laughed, glee in his voice. "You won't hurt it; it isn't that fragile."

It had the stiffness and flexibility of brocade stretched over a fine metal filigree.

"Actually," said Cotten with a confidential air, "it's the shape of a one-piece coveralls with a hood. Not really a cloak at all, you see. Some of the boys call it the Pajamas, but they're the ones without a soul."

"Phil, get on with it," urged Luther. "You haven't all night." Cotten looked hurt but complied.

Josh listened as if to a class lecture. There was a grid of incredibly fine wire embedded in the fabric . . . The complex magnetic pattern bent space — no, Cotten said the *oriented* space — in the direction of oncoming light rays . . . There were 10,533 miles of wire coiled between the inner and outer layers of the duralon . . . There were 766 transistronic lace-points for each mile of wire (Cotten emphasized *each* with a beatific smile) . . . After a while the lecture went off into realms where Josh's general training foundered. He stopped listening as his mind canvassed the possibilities opened up. They seemed unlimited, and for the first time he began to think ahead eagerly.

"What was the trouble with the Council?" he asked as Cotten appeared to be running dry.

"Two things." It was Luther who replied. "The basic argument of the antis was that it was mad to take our one and only ace out of the hole and ship it right into the heart of the enemy's country. Lepelletier talked for five minutes painting a horrible picture of what would happen when the U.A.R. had both the force shield *and* our Cloak. I'll admit, I shuddered too. I might add —" this to Walter — "he spent one minute of his precious time intimating that I personally had lost my marbles. His sidekick from Ontario talked the same way. They didn't object in principle but insisted that it was something to be saved till our backs were grinding into the wall. My answer was: that's *where* we are!

"What they don't see," Luther exploded, as if caught up again in the heat of the debate, "is that force shields make possible for the first time in four generations nothing less than a sneak attack of annihilation. Once they've got the domes up, what's to stop *them*—" he stabbed his finger to the south—"from a general launch-up while they sit pretty? Mention Pearl Harbor to Lepelletier and he guffaws as if you brought up the Punic Wars. *Idiots!*

"Even so we'd've had a majority sooner except for the shimmer. It reinforced their argument in exactly the right place and made the plan seem like an irresponsible gamble."

"Don't you think," interposed Walter, "you'd better tell Josh here about the shimmer before you get wound up with politics again?"

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Luther apologized and turned the floor back to Cotten. The latter's ebullience was gone. He spoke as if confessing under torture.

"The Cloak's really still in the experimental stage, Brock. We haven't got the bugs out. As far as your work is concerned, there's just one big, beautiful bug.

"As I told you, the magnetic pattern set up by the grid operates essentially by orienting space in the direction of the incident ray. Now, what happens if there are two incident light-rays from different directions falling on the same points? The grid has to make a choice. There's no problem if there's a wide differential in intensity between the two rays. But *if* the gap is narrow and — oh, depending on a couple of other ifs, the incoming light energy will not be carried away and out of the system; it'll suffuse over the grid.

"What that means in visual terms is that the whole Cloak will shimmer. Like a ghost."

He made an open-hand gesture to say, *That's the way the ball bounces,* and looked appealingly at Luther as if wanting him to say, *Now, now, it's not your fault.* The other two men were looking at Josh.

Josh found himself saying carefully: "Doesn't sound too bad. It shouldn't be hard to keep out of the kind of situation you describe."

"No, it shouldn't," agreed Cotten with quick enthusiasm.

Luther's voice came from near the window: "Phil." The tone was one of pleading. "You're not *selling* the damn thing to him. Give it to him straight. It's his skin."

"That is, there are all those ifs I mentioned," amended Cotten, nodding his head eagerly at Luther as if to appease him. "Here are some we've worked out so far at least in general terms. One: the higher the intensity of at least one of the incident rays, the wider the differential can be and still produce a shimmer. Two: the smaller the angle between the two incident rays, the greater the possibility of a shimmer. Three: the more nearly the light is composed exclusively of a uniform wave-length, the less the shimmer . . . That's clear, isn't it?" he asked hopefully.

"Phil," said Luther, "let's put it in terms of real situations. For example, you were telling me that sunlight . . ."

"Sunlight's the worst — right," said Cotten. "You're more likely to shimmer in it than not, because of reflected rays. That follows from one and three, doesn't it? And of course, the shimmer itself will be brighter, maybe a glint. That's if you're in direct sunlight, I should say. If you're entirely in the shade, then it's good to keep in mind that if *all* the incident rays without exception are polarized, there will be no shimmer. We don't know why yet, but it's probably related to the similarity between space-orientation and polarization. However, even in shade, you've got unpolarized light too, you know, so I wouldn't rely too much on that. Fact is, using the Cloak by daylight would be darn risky.

"Now, at night's another matter. Even in fairly well lit streets the general intensity is relatively low. Here's a happy thought: suppose you had

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one ceiling light in a room — say, 200 watts. At that scale of intensity, two incident rays would have to be almost exactly identical in intensity, to three decimal places, to produce a noticeable shimmer."

"Tell him about diffused lighting," prompted Luther.

"Best, the best!" crowed Cotten, as if over a victory. "Can't do a thing to you. I mean our artificial diffused-lighting systems, not diffused natural light. It's all polarized. The offices in La Paz will have it, but I believe the street lighting is still the tube variety."

"Let's see now," said Josh. "It looks pretty safe at night, then, under any circumstances . . ."

"Not exactly," said Cotten glumly. "You'd be a sitting duck in any interior more or less brightly lit by a number of tube-type lights. I'd watch out for car headlights. Then there are imponderables: suppose two people point flashlights . . ."

"Haven't you been able — I mean, isn't it possible to work up a warning eye that would test whether a light conjuncture is safe or not, some kind of testing gadget?"

Cotten looked crushed. "We're working out the theory for it now. But you see what it would take. Practically, it would mean packing quite a number of the reactions of the Cloak itself into a small space. Now that brings up the main bottleneck: miniaturization.

"Look, when we started this project, the figures said that we'd have to use a given volume of wire — just the wire alone — to operate on a volume of space half its size. In other words, the whole thing was impossible. It's like the problem with the early rockets. The first fuels didn't have enough power to propel the engine itself into space, let alone a payload. That's how it was with us. I mean, to start with, the amount of wire we needed couldn't orient its *own* volume, let alone the space it enclosed. So we cut it down and down and *down* . . . We've miniaturized and miniaturized to get the Cloak. But a warning eye — now, that would mean more or less a miniature of the Cloak itself.

"Anyway," he concluded, "a warning eye isn't the answer. What we've got to do is eliminate the shimmer itself. We can do it too!" Cotten's voice began rising in fervor. "The theory's all worked out. Even lots of the details. All we've got to do is add a twin-sheath to the Cloak with reversed orientation." His head fell forward and down as if he had just been stabbed to the heart. "Only that means doubling the amount of wire. And then we'll be right back where we started, with a 15.4 per cent overage to get rid of, because —"

"Gentlemen." Luther turned back to his desk and spread out his hands. He succeeded in sounding like patient sweet reason. "The shimmer is not going to be eliminated by the time Mr. Brock leaves, which will be —" he glanced at his watch — "in three hours." Josh suppressed a start. "Meanwhile, now, if Mr. Brock doesn't have any more questions about the shimmer, we'd better come back to the Council decision, or the

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part of it that affects Mr. Brock closely."

In spite of the reference to Josh, he addressed himself to Walter:

"Toward the end of the debate it looked as if the plan was going to be defeated, primarily because of the shimmer. I can't say I'd really condemn them for being shy of it. Here, as I said, they had the argument that we were taking our one and only reserve weapon and shipping it direct to the enemy's headquarters, in fact to their technical headquarters where they'd be sure to be most sensitive to it. And on top of that this device has the inconvenient habit of announcing itself. Gruening had a few sharp things to say about that to put it in a positively hilarious light. He even got a grin out of old Silverlocks himself. Frankly I figured right then that it was sunk.

"Then there was another decisive line of attack. Wardman argued — with considerable justice, I must say — that not only must the Cloak not be allowed to fall into their hands but they must not even know it exists. Because at least ninety per cent of its initial potential value is going to be based on surprise. Let them once know we even consider it realistic, and *pouf*." He waved his hand.

He was justifying himself, explaining why something had had to be done. Josh felt a point in his stomach beginning to contract on itself.

"So I proposed a guarantee that they could never get the Cloak even if it failed us, or guess that it existed. I had to. That's what they were worried about. We had Joe Lederman in, right on the spot, and he confirmed that technically such an arrangement could be gotten up in a few hours."

Luther looked inquiringly at Cotten, who nodded miserably and muttered, pointing a thumb at the Cloak, "It's on now."

"Lederman was going to adapt a Rousseau detonator, in the form of a belt. I might say that we rejected the idea of leaving it up to the agent himself, as a voluntary act dependent on an evaluation of the circumstances. The detonator is wired in so that it goes up at a shimmer."

Walter swung around, as if to protest, but what he said was, *"At any shimmer? At the first shimmer?"* — indignantly, inquiringly, incredulously all at the same time. "Isn't that extreme?"

"Wait a minute," said Luther. "Here's one other piece of information for you. There's a switch on the detonator. It has to be turned on by the agent himself. It was agreed that the agent is to be conditioned to turn it on when in the presence of possible observers; in effect, whenever anyone's around to see."

Clever, thought Josh. *It would be difficult to condition a man to blow himself up, but they'd gotten around it.*

"Sure, you're right, Walter," Luther continued in a warm voice. "But take my word for it, it was this or nothing. If you'll just assume that part of it, I'll leave it up to you. Go ahead, you decide. Do we send a man or not?"

They were talking as if Josh weren't there, as if it were an abstract problem. The contracting point in Josh's stomach extended itself to a

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line that knotted back on itself every instant that Walter failed to reply. As if seeing through Walter's mind, he stared at the images that welled up, weighing, estimating. The knotted line was tight in his gut like a coiled spring—

"No you don't decide!" he yelled. He sprang to his feet, and with the action his insides were firm and good. "It's up to me! Just to me, you hear? Me alone!"

IV

It was up to him alone, as he paused on a switchback of the Alameda Santos winding up to the Ciudadela.

The old center of the city around Plaza Murillo was about 500 feet below by now. He could see the glint of the river winding its way through, the lights along the swath cut by the Avenida Arce, the bulk of the newly rebuilt Hotel Guibert, the areas of bright street lamps and dark shadows marking the astonishing contrast between the modern sections and the old Indian quarters, with their steep narrow lanes, reconstructed by the Tourism Department. To the southeast the glowing snow-capped peaks of Illimani seemed only a stone's throw away. Across the *quebrada* in which the city nestled like a splash of buildings on the side of an elongated crater, the castellated pinnacles glittered back some of the bright starlight.

He forced himself to wait another ten minutes, breathing slowly and rhythmically. The altitude here was approaching 13,000 feet. Fortunate-

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ly there was little climb left. After another couple of bends, the alameda was going to straighten out and slab along an almost perpendicular part of the mountain wall, blasted out of solid rock.

But he knew that the *soroche* doesn't necessarily strike immediately. All forms of altitude sickness were capricious and the *soroche* was notably so. Already the dry air was cracking his lips. What if a nosebleed started? Common enough among the visitors who came to La Paz from the lowlands, but not an emergency for *them*.

Was his mind getting duller? One of the effects of the altitude, he'd been warned. Were his nerves getting jumpier than usual? Even tourists who were innocent, safe and respectable were affected peculiarly by the thin air. Was his heart pounding? Walk slowly, rhythmically, breathing in unison with the steps, no sudden movements.

He reviewed the plan of action ahead; there were few details to review. He had only to get next to Sciacca and stick with him, and see.

Light was already filtering into the east as Josh entered the Ciudadela complex of towering buildings. Good timing. That gave him a few hours to get through the first steps in case of delay. Sciacca was supposed to be the kind that put in a couple of early-bird hours of work.

The Science building was another quarter mile down the central mall, its base structure cast in the Greek-temple style of government architecture once popular also in the States. Incongruously, from the hind end of this imitation-classic pile rose the skyscraper column topped with pinnacles that was characteristic of the Ciudadela.

Josh made his way to the rear door, which would be the only one open at this time. Looking down at his feet and shuffling them in the growing light, he could see the specks of dirt adhering to the undersoles. That would have to be taken care of as soon as he was inside. He would also have to swab the Cloak. Even though there was not a soul in sight he could not take the chance of doing it out of doors.

The door was probably unlocked, but Josh did not enter. Instead, his hand turned the switch on. *Why?* His heart gave a leap, and he swiveled around. Not a soul in sight in any direction.

"Damn you for an idiot, Mr. Brock," he thought to himself as he realized that, just as he wasn't opening the door because there was probably a guard on duty behind it, so also this same guard might at any time open the door and look out. Still it was disconcerting to feel that one's own hands were as alien as the surroundings: a spy within the self.

He waited.

The wait seemed interminable after only fifteen minutes. This step would be among the easiest, but taking any chance was absolutely out. A vein in his temple started throbbing. If the door swung a little ajar, mightn't the guard inside ascribe it to a weak latch and the breeze? That was pretty silly, given the obvious weight of the door. Besides, that was exactly what he was supposed to

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avoid, any accumulation of coincidences, even explainable ones. *Wait.*

Then there were voices inside, a man's and a woman's, and the door started to swing ponderously outward.

Josh poised himself. People opened doors in different ways. Would the guard be right behind, blocking the doorway? He almost breathed in the face of an old Indian servicewoman as she slowly started to emerge with a *Buenas noches* for the guard.

He quickly lowered his head, then his whole body, crouching. As her legs cleared the threshold, he darted a look behind the door. The guard was holding the door open with one outstretched arm, his body still momentarily turned aside for the woman to pass. Josh twisted around the doorpost to the left, and was inside. Instantly he froze, immobile, eyes fixed on the guard's face three feet away.

Not even an uneasy look there. Good. He had jumped to the second square.

Backing away as the guard shut the door, Josh moved slowly and smoothly down the hall, past a succession of offices. The door of one was open about a foot. He paused outside, heard nothing, quickly looked in and, enlarging the space only a little, slipped inside.

Even better, there was an inner office too.

There, behind a desk for triple safety, he detached the socks in a couple of minutes. Despite himself, he stared for a moment as his feet appeared. With an impatient shake of the head, he affixed the new socks — in one motion, since they simply snapped into place. Groping in his pouch he took out a saturated sponge and systematically swabbed the surface of the Cloak. Although he himself could not see it, there was likely a fine deposit of dust on it now. It might show up as a cloudiness in the air in some light.

Now there was nothing else to worry about till he got to the fifteenth floor. Walk up all the way — it had to be that. Running the elevator at this time was out of the question since no one was supposed to be around; and running the elevator later would be out of the question because there *would* be people around. It was one of the penalties of the Cloak.

He slowly crept up from landing to landing. The vein in his temple started throbbing again; it must be the altitude again, in spite of the deliberation of his heavy-footed right-up-left-up. The *soroche* was holding off, thank God.

On the tenth floor he had to stop for a rest. There was no sitting down; specks of dirt on the seat would be even more conspicuous than on the undersoles. *Don't lean against the wall.* He found that he was holding onto the banister and hastily released it as if it were hot.

At the twelfth floor, signs announced the Ministry of Science, but he knew these were only the public offices, including Sciacca's. What he wanted was the minister's private suite, where he worked when he had to get away from all except top-

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echelon affairs. There too was his private laboratory, which he maintained as a kind of personal hobby.

The hall of the fifteenth floor was a blaze of light where the others were still only partly lit. That was probably a good sign. He reviewed the ground plan of the floor in his mind: *go to the right down to the end of the hall, and then left to the last door on the right-hand side of the east corridor.*

The first objective was to spot the guards and the booby traps. Think over every move; move slowly; take no chances; trade time for safety. After all, there was no reason why he couldn't pull it through, with enough care. He flattened himself inside the stairway doorway and peered down the hall.

The first guard post was just where it was supposed to be, set in the wall at the end of the hall, facing him. Two guards listlessly looked out through the armor glass, apparently in conversation but their eyes remained fixed in front.

The ray gate? There it was too, about halfway down.

He would have to assume it was full-length, down to the floor. There could be no test to see if he could undercut it by belly-crawling. Here was the second vigil.

He moved slowly down the hall, stopped just short of the gate, and leaned against the wall, then straightened up abruptly. For the first time since he had left the hotel, his fingers itched for a cigarette and were roughly clenched. A hall clock was right in front of him; he shifted over to the opposite wall so that it was out of sight above his head. The hands moved too slowly. A tic started in his right thigh.

What time was it now?

He glanced at his wrist — or tried to—and almost cried *Idiot!* at himself. He flipped the watch out of the pouch, cupped it in his palm, and saw it was not much later than 6.

The hands on the wall clock pointed to 7:10 when the elevator started to whine in the shaftway. First passenger. But not the right one. It was not until 7:25 that the elevator stopped at the floor and the door rolled open.

The man was short, thickset, swarthy — Francisco Sciacca, all right, without a doubt; with that Sicilian cast of features, not uncommon in the Argentina province, that had been promised by his name. The guards behind the glass stirred and one lifted a receiver.

Sciacca waved a hand to them in greeting and strode down the hall. Josh straightened up, all jitteriness ended. Tensely he flattened against the wall as though the Brown minister might brush him. Eyes glued on the approaching form, he mentally coordinated his muscles with the rhythm of Sciacca's steps. As they came abreast he slipped himself over the line in one fluid motion, and stopped.

Third square!

No use trying to keep up with Sciacca's rapid pace; haste was dangerous. Moving smoothly down the hall he reached the corridor turn just in time to see Sciacca opening his office door. There at the end of the

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east corridor was the second guard post, and about ten feet before the office was the ray gate.

It would be boring and a strain again, but he had to settle back and wait as before. His hands played with the contents of the pouch — minuscular camera, needlegun, flash, odds and ends — and then were energetically folded behind his back; this was another bad habit to get into.

It was one of the guards from the first post who jumped him to the fourth square, twenty minutes later.

Now at least he was out of the run of the corridor, where traffic would become heavier as the offices opened up to the day's activity. Two squares to go.

He felt the jumpiness in his nerves again as he settled down at the side of Sciacca's door. The momentary need for action, when he had coordinated his body with the guard's passage, had roused them and now they quivered with enforced passivity.

The guards were chatting behind their glass but no murmur penetrated. Suppose Sciacca had no visitors at all today? Nonsense; he would have few, but some. More important was the time element. It wasn't so much like a game of chess, maybe — it was more like a football match. You might get down to the five-yard line, but unless you drove over before the whistle, back you went to the start for the next half.

How long could he stay in the Ciudadela without food or sleep and still retain enough efficiency to keep every nerve alert every minute? Maybe two days. If the damn *soroche* held off. Maybe not that long. Was he alert right now, or was a sort of dullness already settling over his reactions? Unless he made the last square today — unless he made the *next* square in time to make the last square today — back he would go to the starting point. No, that mixed up chess and football; to hell with it. Wait 'em out; all he needed was one visitor to come along.

As a matter of fact, it took four visitors and two and a half hours. People open doors in different ways. It was probably an index to character, he thought moodily as he cursed them. There was the wizened billygoat who slipped into Sciacca's office as if forcing himself into an airlock against pressure. There was the dignified old crock who opened the door at the guard's signal and then deliberately turned around, practically backed his way in, and carefully shut the door before moving away. There was the college-boy type who had flung the door open, turned back quite unnecessarily to wave at the guard, leaning on the knob. There was a possible opening there but Josh restrained himself from taking the chance.

His impatience vibrated against an amusing thought and he nursed it along for its therapeutic value. *There's the research paper nobody has written yet.* He grinned. *One Hundred and One Ways to Open Doors and Enter Offices, Carefully Classified by Mode, Manner and Mien, Micrometrically Measured by the Millimeters Available for . . .* As the pioneer in the field, he would

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write the monograph for the instruction of his successors. *Brock's Principles: Make it on the entrance only.* Trade secrets of a profession sharply limited in numbers . . .

The next visitor was Type 1A. Here was his chance.

With a twist of his body that told him his legs had begun to get stiff, Josh was inside the office with plenty to spare. Still crouched, he took a step to the right and immobilized, barely hearing the words being exchanged between the minister and the newcomer.

Under his feet was a thick rug and he had seen it ripple and flatten as he stepped on it. That wouldn't do. He slowly straightened and looked around, avoiding looking at the spots of compressed pile as if he would thus call them to the others' attention. Excellent — around the room, between the rug and the walls, was a foot-wide strip of bare plastic floor.

The visitor, apparently a courier, had delivered a document to Sciacca, who was reading it with his face turned three-quarters toward the windows. Standing therefore with his back turned mostly away from the doorway.

Josh moved back to the plastic strip, tiptoeing — whether because that left a smaller impression on the rug, or because it merely made him feel better, he would have been unable to say. Once off the telltale rug, he carefully stepped to the wall which was farthest from the desk, between the door wall and the window wall.

Fifth square.

V

The courier left after a minute, and Sciacca dropped back behind his desk, absorbedly scanning the pages of the thick sheath of papers in his hands, making marginal notes frequently. Josh consciously sought to regulate his breathing to steady and shallow respiration. No side-swishing. No playing with the contents of the pouch. No shuffling. Who knew what other intangibles there were — the kind of intangibles which raised the eyes of fellow airbus passengers to meet yours if you stared?

Outside in the halls and outside the windows, the bustle of daytime activity was beginning. There would be plenty of equally muted distractions. Sciacca might stare at the room's emptiness with a momentary puzzled frown, not knowing himself why. But it would not be serious . . . if he held his nerves in order.

He looked again at Sciacca's face as if searching for a symptom of the malady of which Walter had spoken. Back in Washington, after leaving the office, they had gotten down to details in the headquarter's bar: *All right, you're finally in Sciacca's office. What do you do? How do you open the vault in front of him?*

"We have one piece of real luck, Josh. Of course, you could wait till Sciacca leaves the office, but from what we hear, that might not be till the end of the day. And then you're likely to be locked in till the next morning. That could work, but it's not good. So — the piece of luck. Sciacca has a bit of a history of epi-

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lepsy. He hasn't had an attack for five years, or so it's said; but he's sensitive there. If it happened to him alone in his office, he wouldn't tell a soul, for sure. He wouldn't be sure himself. Well, you're going to give him a fit . . ."

Remembering, Brock's hand mindlessly moved toward the pouch, where the needlegun reposed with its special wad, and was jerked away. His eyes inventoried the room: another desk; file cases; bookcases lining most of the wall space; the inevitable maps; two portraits, Einstein and Isherland; a lot of folding chairs piled to one side. *And the vault.*

It was directly behind Sciacca's back, set in the wall at eye level, about two feet square. The door was a simple sheet of metal, dull black, without sign of a knob, dial, keyhole or hinges. It probably slid sideways; but no matter, *he* wasn't going to open it. If it were about two feet in depth too, the model couldn't be a very large one!

Patience!

In the opposite wall was the open entrance-way to the rear alcove. He knew where it led. Off the alcove, out of sight now, was the door to Sciacca's personal laboratory. He slowly drifted toward and into the alcove, and saw with relief that the door was partly ajar, perhaps seven or eight inches.

From this side only darkness could be seen through the gap. At least there could be no one in it who might catch him unawares. Still he ought to know what was there.

He moved up to the door and tried to peer through; no go. Should he chance it? He estimated that the opening would have to be increased to about fourteen inches in order to let him through. Suppose he spent the next half-hour or so edging the door through those extra inches . . .

He stood on the hinge side of the door just in case Sciacca should abruptly get up and make for it himself; keep your eye on the alcove entrance every minute. The phone rang every ten minutes or oftener, but there were no more visitors. No wonder he'd had to wait two and a half hours for four chances at the door. *Don't rub your thigh.*

The phone calls were about official routine for the most part. After a while Josh began to notice how the conversations were going:

"Look, old pal, can I see you and Luisa next week? Awfully busy right now . . ."

". . . Senor Ramirez, please . . . Rodolfo, would you take a chore off my hands? I was foolish enough to accept a speaking date at the Instituto de Justicialismo for tomorrow. I'd appreciate it immensely if you . . ."

"Yes, yes, I know you have a legitimate complaint, but I'll have to refer you to Guterriez for satisfaction. It's out of my hands . . ."

Check. Sciacca was postponing appointments, calling off activities, passing on responsibility, telling his callers as politely as possible not to bother him, extricating himself from involvements. Of course; Pizarro had said he was now completely immersed in the work on the Shield.

The lab door now stood about

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twelve inches open. *Patience!* Wasn't it time for Sciacca to go to lunch? He probably had lunch right here. Josh already felt as if he had been standing there for days. *Every sense alert!*

The phone rang again:

"Sciacca . . . What about? Sorry, can't make it . . . No, I haven't got it any more [Josh snapped to attention: does he mean the model and plans?] . . . They took all the stuff out of the vault two weeks ago. You'll probably find it down below [That meant in the city] . . . It'll be going to Buenos Aires but you can probably still get at it. Tell you what, ring Emilio and he'll help you out . . . Not at all, not at all . . ."

Of course: *check* again. The contents of the vault had been changed two weeks ago. But then, if Pizarro had stated positively and without qualification that the stuff was in Sciacca's vault, then according to Walter the fact needed no confirmation.

The lab door now stood half open.

Josh eased through and into the darkness beyond. As his eyes adjusted to the gloom, he made out a large chamber: tables strewn with apparatus; bulky packages in a row of stout shelves against one wall; right near where he stood, a soldering corner; further away, shapes still too dim to be described except for a row of flasks that caught some of the light from the half-open door. It was the private lab that Pizzaro had reported, but it looked as if it also doubled as a storeroom, and a not very orderly one at that.

Back in the office the telephone rang again. Josh moved back to the door; and as his eyes met the brightness of the office lights again after the darkness of the laboratory, a stab of pain shot through the back of his head.

"Sciacca . . . Yes . . . Listen, Rosita [That was his secretary, Josh recalled], put him off, I won't do it . . . Absolutely not. There's not a moment to spare . . . No, not this afternoon. I'll be tied up here with the conference from one to three at least. [Josh's nerves leaped and bucked.] . . . Impossible! At four I have to be at the airport. Tell him to bring it up again next week. Rosita, will you please phone Basilio again with the reminder for one o'clock. I don't think that'll be necessary for Munoz and Estrada and the others."

Josh's thoughts raced. Basilio — that would be Basilio Domingo Mosca himself, No. 2 man under Santos and reputedly in supreme control of government activities for the party machine, which of course was run by Santos personally. Munoz and Estrada were the ministers of War and Finance respectively. Whoever the "others" were, this was top-level. In one hour Sciacca would no longer be alone; and after that he would be gone.

A wave of panic flooded in; there was a cavernous feeling at the pit of his stomach. "Take your time, Mr. Brock," he told himself. "There's plenty of time." There was a band around his head that compressed his thoughts and kept them from getting through. From somewhere at the base of the back of his head, a brownness was rising.

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Then the break came. At first it looked as if Sciacca were putting through a phone call. He had picked up his sheaf of documents, leaned over the phone and dialed; then he spoke a couple of words into it. Even before he turned around to face the vault, the dull black plate had begun to slide silently. It disappeared into the wall with an audible click.

Two arms moved. One was Sciacca's, holding the papers, upward toward the vault. It never got there. In a whipped motion, Josh's hand darted to the pouch, leveled the needle-gun, and fired into his back without a sound. Sciacca crumpled on the rug.

Fast now! The body would not stir for ten to fifteen minutes. But there was the telephone and the door. Still: plenty of minutes to take photos of the model, photograph the pages of the plans, then leave everything as found. Sciacca would pick himself groggily off the floor, look around in bewilderment and wonder if what he feared had happened to him again. He would not give the alarm; maybe he would even leave the office and make the rest easy . . . .

Josh snatched the papers out of the hand of the sprawled body and hurriedly glanced at them: a report headed "The next Step in Project Shield." It seemed to deal mainly with assignments of departmental responsibility. Interesting, but not what he was looking for. That was in the vault.

He looked in the vault and frowned. Out of his pouch came the flashlight. He pointed it into the cavity and switched it on. His hurried motions slowed down. The light wavered for a moment and then started to make a tight circle as he pointed it into each corner. That was senseless: every square inch of the interior had stood out in brilliant illumination at the first click of the switch.

A moment of tautness, and he jerked down to his knees to pick up the discarded papers. With jumpy movements of his hand he turned the pages more carefully now, looking for the subject headings, scanning the small script of the marginal comments. Then he tossed it aside and with a rough intake of breath, turned back to the vault, pointing the flash in again.

But he had already seen — nothing there.

A hammer blow began pounding at his right temple. The iron band was back, and a second one was pressing down on the top of his head. It was the *soroche*, now without doubt. He pressed the heels of his palms against his forehead to stop the veins from pulsing. He *couldn't* be sick!

Sciacca stirred, then fell back. Convulsively Josh laid the papers near his hand. He still had a few minutes. Hastily he pulled the desk drawers open and looked into each: nothing of interest. Should he give Sciacca another needle? There was no point to it unless he intended to start a search of the office — and of the lab? — in a desperate hope that the Shield and its plans might be found in some odd corner. How ridiculous! Couldn't he think any more? The light from the window was hurt-

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ing his eyes. Inside there was a churning.

With a gasp so loud that it was fortunate Sciacca was unable to hear, he lurched toward the lab door and lay down just inside the darkness. The pressure in his guts eased off. His head slowed down to a dull throb that was bearable.

But he mustn't stay there. He had to get his inert body out of the way. Eyes adjusting to the darkness, he dully examined the rack of shelves against the wall; they ended a couple of feet below the ceiling. He dragged himself over, and, mustering every ounce of strength, silently pulled himself up from shelf to shelf and onto the top of the rack. Then he finally let himself go, gratefully stretching out and pressing his forehead against the cool wall.

From the office he heard a scraping movement. Sciacca was getting up. There was a slight thud as if he had fallen against the desk and then the outer door rattled open, but it immediately closed. There was a sound of dialing and then the remembered click of the vault plate, closing.

The darkness was lulling and Josh closed his eyes. Shapes pulsated behind his eyelids in time to the tom-tom that beat on the back of his skull.

VI

There were several voices in the next room. Josh swam back to awareness. *Where was he?*

He turned his head and a flash of pain darted between his temples as between electrodes, then subsided. He shook it, and nothing happened; in fact his skull once more felt more or less attached. What was left was the constricting headband and an overall sluggishness. It must be—

He flipped his watch out and it was five minutes past one. The conference was assembled in Sciacca's office.

He carefully made his way down from his upper berth. Reaching the floor, he rested crouching, then rose unsteadily to his feet and dropped on one knee as he staggered. A nice thing it would be if he crashed against one of the pieces of apparatus in the dark! Darting lights appeared before his eyes as he shook his head to clear it: better keep it still and avoid unnecessary movement.

Leaning against the wall just inside the door, he heard Sciacca getting over the preliminaries. The Science minister had a low, growling voice; Josh had to concentrate to hear:

". . . this is the first time, gentlemen, that we have shown the Shield to anyone but us three. But now all of you are going to be involved in the next step. Mass production. We decided you'd better have at least a general idea of what's what."

Josh heard the sound as he dialed, and was already inching forward as he spoke into the phone. As the click sounded, he advanced his face just beyond the portal of the alcove.

The vault lay open. Sciacca was reaching in with both arms extended. There were about a dozen men seated around the room in a scattered pattern, every face turned toward the open vault.

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Sciacca turned around with his hands up over his head like — Josh's head spun a little — just like a tailor holding up a dress to the light, wasn't it?

Was that—? The same short figure—No, it was Sciacca, and he was holding his hands over his head as if to keep the dress from dragging on the floor. Only, there was no dress in his hands; there was—nothing.

The same nothing that Josh had seen in the vault.

The room blurred and dimmed before his eyes as pain stabbed somewhere just above the nape of his neck. He scarcely heard the ejaculations and excited comments exploding around the room. *You idiot, Mr. Brock,* his insides were shrieking. *You cretinous, driveling, sottish, moronic, asinine, clodpated, witless, withering blithering dithering imbecile! All the way here, the vault open, everything almost in your hand, and you goose off!*

The room blurred again. Then the Shield was the Cloak? Well, they didn't have to give it the same name. *"I hit it and did I bounce!"* Even as he remembered this, Sciacca was slowly carrying the thing around the room. The second man to stretch out his hand to it recoiled from the touch with a jerk, then reached out again and grasped the fabric, with an amazed smile on his face.

Then the U.A.R. had the Cloak — a cloak, the Shield, whatever. Implications poured in on Josh in a jumble of images. For one thing, that detonator on his belt had been a grisly mockery all along. Somehow the U.A.R. had developed the same device at the same time. An outrageous coincidence, or . . .

Sciacca was talking again:

"At first we were entirely preoccupied with working out the details from the plans, which incidentally came into our hands only six months ago. That may sound like a considerable delay, but there were several technical terms in the English which our men had never seen before and couldn't translate with certainty. This indicated that the North Americans had worked out some brand-new theory before pulling this off; and we had to work it out too, only working backward from the plans.

"At the same time we saw at once that we faced a problem which the North Americans were able to disregard. They were worried about the shimmer; we decided not to try to do anything about that. Our difficulty was quite different. The lacepoints were the basic new development, and each and every one of them contains a trace of cesium. Consider what that means for mass production. I've told you the fantastic figures involved. And we simply can't scrape up anywhere near the amount of cesium that they have up there." Sciacca jerked his thumb toward the north.

"So the last three months have been spent on meeting this situation. It was done, thanks to Joao over there —" everybody looked at a thin, redfaced man with a goatee, who looked out of the window — "and now *look* at that." He waved his hand at the side table where he had placed the Shield. "That model con-

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tains a little more than four million lace-points!"

Someone started applauding and there were several minutes of congratulatory hubbub. Next Sciacca launched into a detailed explanation about the shimmer. Aside from noting that (glory be) they were entirely baffled by it — the original plans, of course, did not include the latest work by Cotten's men — Josh tried to digest the situation.

It was not a coincidence after all. Four million. What was it Cotten had said? He remembered the figures, naturally, as well as he remembered his own name; not even the *soroche* could knock out that part of his training. But what exactly did they mean? There was an idea somewhere in the back of his head — back of his head — back of his head — back back back pounding in the back of his head head head head head —

He just barely saved himself from lurching forward on his face as his knees gave way. He crouched down and leaned against the side of the entrance-way. Sciacca had been talking again for minutes; he hoped he hadn't missed anything important.

"Montanes is going to direct the Sao Paulo part of the operation on the spot. I'm taking the Shield to — well, gentlemen, you don't have to know. Sanchez will be in charge of security. Estrada will get to work immediately on the bonds. Munoz will come along with me."

That was bad. The only one of the lot going along with Sciacca and the Shield was the War minister. And they were going to mass-produce it, even with the shimmer. For night commando raids? Mass infiltration across the border?

The full realization of what he obviously had to do hit Josh.

It was a little after two. In something more than an hour, both Sciacca and the Shield would be gone to an unknown destination. If Sciacca wouldn't mention the place even in this room, it would be a while before Pizarro could again get a reliable fix on the Shield; and who knew whether it would be accessible then?

In short, he had to steal the Shield right now. That was all. From right under the noses of the top brass of the Browns. First of all, in order to throw a crimp in their schedule. Second, to learn how to duplicate the improvement which Joao Alvares had devised in three months of work.

For it *was* an improvement, even if the North did have enough cesium. Think of the saving in material, cost, weight, time and . . . there was something else. It was something easy to think of. If only he *could* think with all that hammering inside his skull . . .

Anyway, he had to snatch the Shield. But how was he going to get it out of this room, this building? Worst to worst, he could take a chance, but how much of a chance was there?

There would be little trouble getting his hands on the Shield to begin with, but then it would be a gamble whether he could get out of the room before Sciacca, or someone else, felt for the thing and found it gone. Then he would be a goner; the mission

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would be a goner. There would be an outcry, the exit barred without hope of escape, until a suitable pair of flashlights were brought, probably from the guard post, a matter of no more than a minute. The twin lights would be flashed around at every square inch of space to pick up the shimmer, into every corner of the laboratory too.

Not only the Shield would shimmer; so would the Cloak. Even if he could stash the Shield away somewhere, and he didn't see where, there was still his own Cloak, which would betray him in a few minutes.

Somehow the pounding in his head had stopped as he groped desperately for a course of action. The Shield would shimmer, the Cloak would shimmer, there were two shimmers to watch out for, one plus one equals two . . .

Just like that, it came to him, in one piece, without an intervening ratiocination. What came was the memory of three things Cotten had said, and the words were framed in what he had just heard from Sciacca. It was even easy, and maybe not even much of a gamble.

Just at that moment, two of the men were dismissed by Sciacca and left the room. It was a break: Josh realized that when the Shield was found to be gone, and *if* it could not be found on the premises, suspicion would turn quickly to these two, and provide a plausible channel of suspicion. Even his limbs felt sound now. This was the time, while the feeling lasted.

Sciacca was still rehearsing the details of assignments and plans, in his gravelly voice. That would go on for about another half-hour. Josh started inching his way around the periphery of the room.

He used the crab-sway. Back turned toward the wall, facing into the room every second. Shift your weight by swaying right; lift the left foot an eighth of an inch above the floor and set it down an inch away from the right (no clicks); sway left . . . sway right . . . sway left . . . He began slowly, fixing the rhythm.

There was the muted stir of the streets outside the windows; there was Sciacca's voice itself, fixing the attention of the people in the room; this part was not hard. He quickened the tempo of the crab-sway like a coxswain speeding up his oarsmen, without a falter in the rhythm. That band around his head was easing.

Then he was within arm's reach of the side table.

He had forgotten: did that brocade-like fabric crinkle audibly when grasped? He extended his hand and touched it — pinched it — folded it. Of course it didn't; the fabric had to be noiseless in order to be worn secretly in the first place. But it could swish. Moving in slow motion, he rolled it into a bundle and tucked it under his right arm. Sway left . . . sway right . . . sway left . . .

Back in the lab, he worked silently with the Shield for a bare two minutes. He could feel the reaction bearing down on him in revenge for the short period of relief: in a moment or two his head was going to erupt. Quickly he climbed up on the shelf rack and lay down. A storm was

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raging in his head and guts. How long did the *soroche* last, damn it?

He barely heard the explosion of angry noises in the adjoining room, the pandemonium of excited cries, the rushing and trampling. And finally the lights . . .

VII

Walter reached over and put a glass in his hand with an air of deference that was all the more flattering for being unconscious.

"I would have seen it sooner," said Josh, "but for that skull-splitter. It was literally as simple as one-plus-one, after what Cotten told us. He had half the solution, the theoretical half. *They* had the other half; and naturally, without the theory, they didn't know it. Alvares had licked the problem without knowing it, just because the U.A.R. lacks cesium. He had the right answer to two different questions.

Walter took a long swallow from his own supply and stretched himself with a luxuriously expansive gesture. It was good to feel you were ahead. "I can see it now, sure," he said, "but what put it together for you?"

"The figures," said Josh. "When Sciacca said 'four million' I—"

"Four million?"

"Four million lace-points in the Shield. It invited comparison with what Cotten had told us. Even with all that hammering going on in my head, it forced me to think of the figures *he* had been so excited about. 10,553 times 766—there you have it. Something over eight million. Now if I got his explanation straight, there had to be a fixed ratio between lace-points and length of wire, so it meant that the Browns had not only reduced the number of points, but also, necessarily, the length of wire by the same proportion. Of course, *they* weren't concerned with the length of wire, being hynotized by the question of reducing the use of cesium in the lace-points. But be that as it may, it meant that, in that Shield before me, there was something like half the wire mileage of my Cloak. All right, that's what Cotten said he was looking for—a 'twin-sheath' that wouldn't *double* the amount of wiring, since that would mean an overage of 15.4 per cent. Well, there was enough of a reduction in the Sheath to take care of that and a lot to spare."

"So you just turned the Shield inside out to reverse the orientation and climbed into it," said Walter, as if tasting the words. "Okay, you deserve it."

"It?"

"My good friend, Mr. Joshua Brock," said Walter, getting up and waving a glass which no longer had enough liquid in it to spill. He spoke with a singsong as if declaiming, to take the sting out of the words. "I must officially invite you to remember one teeny-weeny-weenchy loose end. You didn't find out how the Browns got those plans."

Josh nodded his head gravely, and then shook it, both gestures meaning the same thing.

"Somewhere in Washington," continued Walter oratorically, "there is a remarkable spy for the United

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American Republic. There could be more than one. He, or they, may now even have the Shield — with a shimmer."

This time Josh merely nodded his head. He had not forgotten that loose end.

"And," Walter went on, "you are the only, sole and exclusive citizen of this commonwealth who has acquired experience in this new game. So the brass met this afternoon—" he dropped the elocutionary tone and spoke simply now—"and you are now the honorable Director Joshua Brock."

"Director of what?" asked Josh slowly and carefully, as his stomach tried to squeeze itself into a smaller space.

"Counterintelligence. The Cloak-and-dagger department." END

WHEN TO MOVE

Continued From Page 5

National Aeronautics and Space Administration guess wrong, they have 100 senators, 400-odd Congressmen, a President and God's own quantity of pestering newsmen to answer to, and it is likely that their lives would hardly be worth living for a while. (And their opposite numbers in Redland might not have that problem at all!)

We do believe, very strongly, that the quantum jumps in spacecraft development are proceeding at a mencingly slow pace. We're given up entirely on nuclear-propelled craft like the Orion project; our plans for the future are both modest and finite. Slowly we advance; and modestly we look no farther ahead than the things that we know perfectly well we can achieve. This is a doctrine of caution. And history tells us that playing it safe can be a pretty dangerous game . . . .

We would go even farther than that. It almost looks as though the custodians of the world's space programs, conscious of the vast seas of money that have been invested in them, are if anything deliberately turning their backs on any possible quantum jumps which may overnight obsolete the tremendous capital investment in gantries and oxygen-liquefiers, in tracking stations and bunkers.

But — bearing in mind at what tremendous cost in dollars, in manpower, in air pollution, in preempting of valuable airspace and landspace we manage to get one or two men into orbit these days — does anyone doubt that our present space program *needs* to be obsoleted? There must be a better way! — Or if there isn't, space travel will probably stay in the sf magazines forever.

So if the space program in real time hasn't quite corresponded to its anticipations in science-fiction magazines a decade ago, we're not a bit sure that it was the magazines that were wrong. There may just possibly be something wrong with the imagination and daring of the people who run the space program!

— THE EDITOR

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THE WORLDS THAT WERE

by KEITH ROBERTS

He lived in dream worlds — and had the tragic gift of making them come true!

I want you to see what I can see. I want you to see it very clearly.

It's the evening of an iron-gray day. The light is draining out of the sky now like dirty water leaving a dead void, upside-down and bottomless. From the void a drizzle falls, endless and soaking. The drizzle has been going on all day. All day yesterday too. Not even enough guts to call itself rain.

I'm standing in a little park. It's maybe a quarter mile square, bordered on two sides by railing and struggling lines of trees, on the others by walls of dull brick with buttresses set at ten-foot intervals all the way along. Above the farther wall, houses hump stolidly under their glittering lines of roof. Paint-peeling, brown and sooty-pink, show-your-plumbing, outside-privied houses; nasty little houses, tall and mean-shouldered, wet-footed. Bathtins hang on lavatory walls, bikes rust in their sheds among heaps of coal, socks and

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underwear hang despirited as they soak up the day's fall of water and smut. I can't see all that, but I know it's there.

Behind me the grass butts up against the side wall of a foundry. The brickwork has been extended with corrugated iron; the sheets hang any old way, lapping over each other, patched and rotting. The weathered paint on them has the brown-maroon pastel color of dried blood, except where water runs across the iron. The wet streaks show black.

A little asphalt path stretches diagonally across the park. At each end of it, patterns of posts are set in the way to keep the yobbos from riding their cycles through. I start to walk along the path slowly, feeling the rain. At the far end, beyond the railings, is a shadow-world of streets. The lights of cars glide out on the main road half a mile away.

I reach the railings and turn back. There's a little playground in one corner of the park. The swings and iron roundabouts are set in squares of concrete, just right for the kids to crack their heads open on. There's a slide with a ladder at the high end. Under the swings are wet leaves. Worms tie love-knots in the grass.

Twice is all I can manage. Once along the path, once back. I try to take it all in; the sooty-darkness of tree foliage, the way it hangs there quiet and drips against the sky, the streetlamps gleaming through it throwing railing shadows on the pavements, the wet drift and movement of the air. I can see now in my mind the miles on miles of houses and streets crowding in round the little park. The pubs and shuttered shops, the closed-down factories, garages with their forecourts gleaming with the rain and the signs for tires and batteries and BMC cars and toilets. I feel now I'm filled right up to choking, I can't take any more. The last fifty yards to home is Hell.

I get my key out, push it in the lock and turn. Houses like mine don't have handles on their doors. I shove the door, squinting a bit in readiness . . . and walk into the Sahara.

I stand quite still, soaking in sensations. The smells first; an ancient sweetness and dryness, the mummy breaths of winds coming in over baking miles of sand; the nearer deep-green evanescence of water. It's evening. Way off the sun is dropping over the rim of the horizon. The shadows it throws are undilating and miles long. Ahead of me is an oasis. Firelight glimmers through the trunks of trees; their tall fronds hang still, reflecting in the quiet mirror of a pool. Round the trees grass has spread out into the paleness of the sand like mould across bread. There are people and black tents and camels. One of the camels belches, a long, opulent noise. Another stirs restlessly and there is the momentary clonking of a harness bell.

I reach the fire and sit down. The people bring me food. Their faces are shadowy in the dusk. The sun vanishes in a silent flash of power and the stars leap into being winking and shivering. I pull my robe around me. Desert nights are cold; in the

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morning there'll be a skim of ice on the waterpots. The stars seem to crowd in with their ancient magic names: Rigel, Betelgeuse, Aldebaran. I don't know which is which. I don't much care. I get to my rest well content. Tonight I've lived with the Bedouin; tomorrow I'll sleep in Nero's golden house in Rome.

The factory whistle wakes me. The desert outlasts it a little time.

I work in the factory, when I can remember to work at all. I'm in the clicking shop. It's a good life. Steady. They play us music twice a day to keep us cheerful. Pretty nice of them. I suppose. My brother Dicky, though, he doesn't work. Well, not like that at least. Dicky's . . . different. So am I, I suppose. We've both got this Talent. If we don't like a thing we change it.

Sometimes I think if we tried we could change the whole damn world. But we never have. We're happy.

I'm talking as if things are still the same, though. They're not, not any more. But I'd like to tell you about the old times. How it used to be.

I don't know how we got to be born, or how we got the Talent, but it was a wonderful thing. Often I wouldn't know till I opened the house door where I was going to be, what world Dicky had made inside the walls while I was away at work. I stepped into South America once, in the long-ago, and saw pyramids and crazy buildings with stone combs instead of roofs, and priests dressed all in feathers and jade. And I met the *Conquistadores,* and helped them crack the rubies up with hammers to see if they were real, and brought home skirts of knotted string and quills of gold. Other times I was in Timgad and Petra and Ur of the Chaldees and Tiryns of the Great Walls and Knossos when the pirates burned it down, and Ilium-Hissarlik when old Helen was there. I couldn't tell you all the places I went to, all the things I saw.

That was why I used to go out walking. Autumn was best, with the street lamps dingy and yellow and the puddles everywhere and the rain pouring down on our little Midland town, on the libraries and cattle markets and garden-fields and gasworks. Lovely. I'd stand outside fried fish shops and look in at the people crowded there coughing and rubbing their hands and waiting, and the fly-brown walls and dirty electric fans and mirrors covered with grease spots and the little clocks set in the yellow imitation marble above the pans and the sizzling fat, the clocks that had always stopped twenty years ago and nobody had bothered to mend. I'd think about all the little people trapped in their iron cages of slums and I'd laugh to think I could get away and they couldn't. They had to sit and take it night after night and there wasn't any hope until they died. Then I'd run home giggling and be in Athens or Baalbek or the Valley of the Tombs of the Kings before the door was closed. But I was only a kid then, I suppose.

Daytimes I'd work in the factory, in the noise of wheels and shafting and the whang and slap of belts and the smell of new leather, with the loudspeakers tearing music into

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shrapnel and spitting it at my ears. And when I was finished I'd hurry down past the greengrocers that was never open and the place that sold catmeat Fridays and Mondays and the pub where the landlord kept saying he'd gas himself and made a mistake the fourth time round and managed it and the woodyard with the hoardings round it and the offlicense where the old men came shuffling in carpet slippers with their chipped enamel jugs ready for the night's beer; all the things I'd lived with since I was small. And I'd get to the park.

Parks are worse than rows of houses. You think you're miserable walking through the slums in an English factory town, but you're not. You find a park instead, locked away in the middle of all the streets with its high walls and playgrounds and rotten swings, and you'll know what it's like to be dead and still breathing. Mill Road Park they called our little bit of grass, because the road that ran alongside it was Mill Road. Maybe you think that doesn't matter; but in our sort of life it does. It matters very much.

I want to tell you about a girl now. Her name is Andrea.

Years ago people used to think there was some sort of magic in names. You know, that if you could find out what somebody was called you had some sort of power over them. I couldn't say about that, but I do know Andrea couldn't be called anything else. The sound of the name, even the shapes the letters make on paper, somehow start describing her. To me anyway.

I'd like you to see Andrea like I tried to make you see the park. That was where I saw her the first time. In the park. It was the night after we made the desert, and I was getting ready for Rome.

When I saw her there I got mad. At night the park belonged to me; it was mine to walk up and down in and cross forward and back and feel the pressure build up till I couldn't take any more and I had to run home and blow all the squalor away in one big filthy splurge of color. Nobody else ever came near it after dark. But there she was all the same, on her own under the lamps, walking with her head down in the rain and scuffing at the path with her shoes, and the shadows trailing long and thin in front of her and behind. I was mad till I realized two people walking in a park are lonlier than one. Then it didn't matter any more that she was there. In fact, it made it better than ever.

I got to the gate and went back like I always did and it was funny but she did exactly the same, coming the other way so we met in the middle of the park and I saw her face. And now it's going to be difficult to say what she was like. I've read a lot of books, Dicky and me both used to read them to find fresh places to make, but every time I saw a description of a girl or a woman I couldn't help feeling disappointed somehow. I knew if I was just sort of to run into the character in the street she'd look more or less like everybody else. Everybody looks like everybody else when you really think about it, in spite of what all the writers say.

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Andy was different. I mean *really* different.

You only see somebody like her once or twice in your life, somebody that's so different you can't ever forget them afterwards. Only maybe there wasn't anything so very different about her face. I mean, you wouldn't call her beautiful. She had big eyes, big dark brown eyes with black lines to the edges that weren't just painted on with something, but you see a lot of people with big brown eyes. I think it was her profile that got me, as she went on by. And I've just realized that I can tell you what that was like because I've seen it before and so have you. Tutankhamen's death mask; the final one, the golden job inside all the coffins right over his poor old burned-up face. The side view of it, the long, long jaw and the delicate little nose making a sort of panther's muzzle pushing out there under the great striped headdress. That was what Andy was like.

I don't mean catlike. Everybody says a girl that's anywhere near being pretty's got a face like a cat or a kitten and it doesn't mean a thing and it makes me wild because it gives half of 'em the idea of behaving like pussy on the hearth and that doesn't do anybody any good. Andy's face was . . . well-designed, is all I can say. Like the mask, or the bonnet of an XKE or the head of a Saluki dog. If you saw them all together, Andrea and the statue and the motor and the hound, you'd see what I mean. A sort of . . . echoing that doesn't age. A shouting Line that's been going on forever. I remember thinking as she went by, I've seen a *woman*. A *woman's* just gone past. That was how she affected me. You see so many females, but so very few women.

I watched her going out of the park. She was wearing a dirty old macintosh, the shoulders dark with rain. The coat was too short for her and so was her skirt because you could see the backs of her knees. She had longish legs, sort of strong-looking, the muscles at the back flat instead of having a curve to them, and little low dark-red shoes that were soaked with water. Her fists were shoved into the coat pockets and her collar was turned half up and half down and the belt was twisted where it was yanked tight round her waist, bundling the material together and she just looked . . . well, scruffy's the only word. As if she didn't care what she looked like and the hell with the world anyway, because she was thinking about something different. But somehow, walking like that in the rain with her feet wet and in a dirty old mac, she looked more *woman* than if she'd been sitting on some throne or other with peacocks round her feet, swilling pearls melted in wine.

That sounds corny but it's the way it was. I can't put it down any other way because if I did it wouldn't be right. I just felt about her in a different way than I'd felt about anybody else. I could still see her in my mind after she'd gone by, the dark foreverface and the great eyes watching out from under a cloud of wiry hair. I felt I could . . . well, live with her.

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I went back to Rome. Dicky was having one hell of a ball.

After that things started to alter pretty fast, mainly because Andy was always in the park nights.

I have one more image of her I'd like to get down. There was a little shelter there that nobody ever used except the kids. I remember her sitting in it, watching the rain weep on the wooden railings and steps, with her shoulders in the old mac pushed up against the board wall; and over her shoulders, each side of her head, the devil-faces of the graffiti were watching too with their awful round scratched eyes. That seemed right for her as well, as right as all the little houses clustered round about. Cleopatra couldn't have lived with them. Andy did.

I shouldn't have taken her home, crammed her into our private molecular theory of history. I'd got it worked out there'd be trouble, but Andy said she didn't care.

The house was big that night. You opened the door and shut it and the bricks were a skin between the factory peering from across the road and a white Pacific beach. And you know what? She didn't even blink.

She stood on the edge of the sand in her mucky old coat, and the collar was still half up and half down and her hair blew in the sea wind while she watched the miles-long blue dazzle and roll and crash of the breakers and the spray spitting up white fountains off the coral out in the lagoon. It didn't last long, though. The atoll went out with a smack and we were in the dark. Dicky was mad.

I called up to him it was okay and clicked the light switch in the little front room. Then there was the sofa with stuffing coming through the seat and the cracked lino and the brass fireirons I never got round to cleaning and the old stained wallpaper Mom used to tell me was there when she was a girl, that I'd never covered up because there didn't seem any point. There was a stale smell too, of muck and old food. I got hold of Andy's arm—I think I was more scared because she hadn't said anything than if she'd started yelling and running round— and steered her through the inner door into the Palm Court I'd just thought of on the other side. There was an orchestra, somebody sawing at a violin and a girl dancing and stamping her heels. But they were hazy because I wasn't too interested in them. There was a bar; I got us a couple of drinks and took Andy's coat and pulled a chair out for her to sit down.

She was wearing an old blue jumper and a navy skirt with a stain where she'd tipped gravy or something in her lap. The skirt was too short. All her skirts seemed to be too short; and her hair looked a mess and she hadn't got a comb and neither had I. But what the hell, it was my Palm Court and nobody was going to chuck us out of it. I thought maybe she might get round to asking how all those vistas of marble and gilt got themselves crammed into our little two up and two down but she didn't. I suppose that was fair enough. After all, she'd taken the tropical beach without batting an eyelid and this wasn't much

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compared to it. Dicky's visual imagination had always been a lot better than mine.

She said she liked her drink though. I wasn't surprised. It seemed right for her to have good taste in wines.

I switched the backdrop to a Sussex farmhouse and she'd got a ring on her finger and we were drinking our own home-brewed elderflower. I reckon the details were subconscious on my part, at any rate I didn't deliberately put them in. She frowned at the ring then grinned and twizzled it round her finger but she didn't say much. The homely images pleased me; they suited Andy fine. I made her father a vicar and brought him in coming up the path pushing his bike and added a swaying backdrop of downland with cattle and a horse, but that was as far as I got. Dicky started to yell and we might as well have been sitting in a c/r tube with a Boeing going over the roof for all I could see of my model farm.

I banged the ceiling with a broomhandle I kept for the purpose. That sometimes used to stop my brother when he was being difficult. This time it was a mistake; the farmhouse vanished and we were in the middle of an antarctic blizzard. Or it might have been the arctic, it didn't make much odds at the time. Andy's hair was flailing round her face and she was screaming out to me. I grabbed her wrist and brought my Palm Court back with a crash. It didn't stay round for more than a second; there was a rumbling and the walls shook and split and outside was Quetta going through the worst half minute of its history. I tried for the farmhouse again and got it but there was a big clump of Isisi palms growing through the floor, I couldn't do a thing with them. Then blizzard, *whoomph,* Palm Court, *boomph* . . . Dicky was really wild. I knew I shouldn't have brought Andy in. No outsider had ever been in our house before, that I could remember. I yelled to her to get out but we were being whirled round that fast she couldn't hear. Then there was the biggest wallop of the lot and the atoll was back with a vengeance and I'd lost her.

I looked round for her and yelled again.

I suppose seeing her pelting along a beach with a rose in her teeth and nothing else on might have been good fun any other time, but not with a *tsunami* right behind her. Dicky had really taken a dislike. I flicked the pair of us out of that with about a microsecond to spare . . . and pulled the plane's nose up as the high jungle of the Mato Grosso reared toward the perspex windshield.

Dicky hadn't finished with us. The engine sputtered and died, hit by a stray shot from one of the revolutionaries. For a moment there was nothing but the noise of the wind in the struts then there was a sort of dull thud from the cowling and flame and smoke ribboned back toward the cabin. Andy was already struggling into a parachute harness; I shouted at her to jump and sideslipped to throw her clear. I saw the 'chute open way below. It had red

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and yellow panels. I followed her out, hoping the tailfin wouldn't take my head with it as the aircraft spiralled into a dive. We drifted down together, twisting the grav bars to check our fall as the satellite's surface opened up beneath us, seeing Saturn dominate the sky with his glowing belts of color and burning rings.

The rock on which I clouted my head removed me from all Possibilities for an indefinite length of time. When I woke up I was impacted in a gray void. I opened a cautious peephole into Dicky's mind. He was too quick for me; he snatched me through instantly and I thumped onto an alien soil.

I sat up. The vista had changed. Above me was a dark crimson sky dominated by a ghostly circle of silver suns.

I groaned and held my head. I'd worked my brother thoroughly into his future-time mode; anything could happen now, and probably would. I stood up, staring round for Andy.

The sky color altered and shifted and there were cloudy streaks running from horizon to zenith and dark clusters of planets. Simultaneously the Thing burst out of the ground beside me, followed by half a dozen others.

The first glimpse suggested the results of a high-speed car smash, a second sight put me more in mind of an abortion on a cat. The cat image was best; the machines, if they were machines, came hopping after me with metallic mewings. I blasted the nearest pair and ran ahead, shouting for Andy. No answer; then I saw her.

She was chained to a rock, Andromeda-fashion; a half circle of the horrors was converging on her. The blaster whimpered again, turning the creatures to glowing puddles, but there were others coming fast and hundreds more thronging the horizon. A Possibility Twist disposed of the rock and fastenings but that was all I could manage, I was getting out of breath. Andy sat up, pushing the hair back from her eyes. "It's the Khan" she said tonelessly. "As he threatened, he has released the Direcats . . ."

I ran again, holding her hand and panting. We were gaining on the clodhoppers when Dicky suggested a hole in the ground. We bounced into it before we could stop. Somehow I got the strength to Twist again but I still lost Andrea.

I got up blinking. I was in a little town of old houses. Fires were burning and there was a smell of empires crumbling; the sky was full of searchlights and the din of planes. Somewhere there was a rattling of shots, and voices were calling. The words sounded French.

I ran awkwardly, crouching and feeling the gun bump my hip. There was a wall. I climbed it and dropped into the back garden of a cottage. One window showed a light. I ran forward again and saw Andy. She was wearing a check shirt and a belted skirt of some rough cloth. Her face was white and she was standing, fists clenched, facing the *Obersturmfuehrer*. The heavy auto-

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matic he was holding out at her looked too big for his hand. *"Nacht und Nebel"* he said softly. *"Nacht und Nebel, Fraulein . . ."*

I swung the gun muzzle forward and up and let fly through the glass. The tommy-gun threw high and to the right. The soldier's body hit the wall; plaster exploded out of the ceiling. Andy dropped.

I thought for an awful second I'd hit her too. I knocked out what was left of the glass with the gun butt and hauled her through the window. The Merc was waiting in the lane with its engine running. We fell into it and I rammed the throttle. The masked headlamps gave nearly no light but we didn't need them, the glare from the burning buildings showed the way. I screeched into a right turn and the houses vanished and there were mountains, a high snowy pass, a roadblock. I saw a swinging lantern, a striped pole dropped across the road. Stefan fired forward over my head, I hit the block, the pole splintered, a body spun out of the way; then the windscreen starred, I ran out of road, there was a cliff, the car was falling.

I landed behind the pile of rocks with a thump.

A shot from the cavalry positions struck a foot above my head, threw up a stinging cloud of fragments and whined off into the blue. I scuttled forward on my hands and knees looking for Andy. I found her; she was lying in the shade, motionless. I turned her over, seeing the paleness under the tanned copper skin. The shaft of the great war arrow was broken off, the head still embedded in her chest. Her body under the buckskin was laced with blood, a trickle showed at one knee. Dicky was getting really nasty now.

She opened her eyes and coughed, and there was blood on her lips as well. "Can the white man's medicine," she asked faintly, "cure the evil in the white man's heart?" My brother always did read too much horse opera.

I wasted five seconds swearing. I saw her head drop and Twisted just in time. The fresh Possibility brought the arrow thudding into the sand alongside us. Another Twist disposed of the cavalry. I guided the canoe out from the bank of the stream and Twisted again.

The punt glided easily while the gramaphone clacked and the willows brushed my shoulders. The water was full of sunlight and nineteen-twenty newts. I surged up to date, hoping I'd shaken Dicky for good, and Andy was lying in a swimsuit showing her hollow stomach to the sun.

My brother was still with us. I didn't see the weir till we were on top of it, mainly because it wasn't there.

The current took the punt and spun it broadside; there was a deep roaring, white broken water ahead. Andy squealed and I snatched us both out as fast as I'd ever moved. I landed on the sofa panting. The weir had been worse than the tidal wave; it had been that much closer.

Andy still had a bruise on her cheek from the Wild West punch-up and I was mad enough to strangle

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my best pal, let alone my brother. I ran for the stairs shouting at him. Halfway up I remembered I daren't get separated from Andy, not with the house jumping like that. I turned back for her in a panic, but by then I was on an escalator full of drunks and the treads were going the other way and I didn't have a very good time. I got to her finally and took her hand; and the staircase elongated, growing sides of glassy pink through which burned shifting patterns of stars. I winced a pair of antigravs out of Limbo. The units accelerated, giving out a thin high whistling that echoed back from the sides of the shaft to numb my ears. The Time-way pulsed like the gut of a snake, trying to flick us out of its Dimension. I hung on and landed on the tattered line outside Dicky's door. Then I stopped.

The house was still wobbling, but it was easier to hold it now he was getting tired. That wasn't what pulled me up. It was just that I'd never seen Dicky before, ever. Not since he was born. I just used to leave his bread and milk outside the door like he was a . . . brownie, or something.

I looked at Andy still swallowing and trying to get her breath. Then I went in. I knew I had to stop him because of her and he wouldn't stop now, not on his own. It didn't take long. He wasn't very . . . big.

I walked down the stairs, ordinary stairs now, grubby and painted brown, and out of the house. I left the door swinging undone.

Andy was beside me. Her hand was tucked in my arm and my hands were in my pockets and there was a big lump in my throat and I didn't know what to do or say. The street-lamps were glowing and the rain was still coming down and the factories and all the little houses stared, and at the bottom of the hill was the park and the houses went on for miles.

I said finally "It isn't any good." I kicked at an empty can some kid or other had thrown down and it went bonking and clonking away between the houses, trundling in the gutter till it stopped. "You see" I said, "we're not . . . normal. Not like anybody else. So I can't see you any more. People like us shouldn't see anybody else. It isn't fair." I kicked the can again. "I'll leave you in the park" I said. "That's where I found you. Then I won't see you again. People like us shouldn't ever see anybody again."

We got to the park and there was the rain glistening on the asphalt walk, and the rusty swings and the foundry wall made out of overlapping iron. I unwound Andy's arm and left her and walked away. I kept my head down because I'd never felt so bad in my life. It was sort of like being crucified.

I'd gone twenty yards before she called me. Hot wires tightened all over me when she used her voice but I kept on walking. I didn't look back because I didn't trust what I would do afterwards. If I turned round I should have to go back with her again and then the whole thing would start all over and next time she might get killed. You could get killed easy mixing yourself up in a

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mess like that with Dicky gunning for you as well. Then I had to look up anyway because the rain and dark vanished like somebody had turned a switch and a wonderful golden-pink light came flooding, a radiance that hurt my eyes.

I shaded my face. The light softened after a moment and steadied and when I could see again I couldn't believe what I was looking at. I was standing at the head of a grassy valley, and all the grass was golden, and as far as I could see there were other valleys and little hills going on for ever; and every hill was crowned with a castle, rosy and faint like the ghost of a flower, and banners of scarlet and satin-white rolled and thundered over the towers. There were horses browsing and deer with flashing horns and people strolling in bright flame-colored clothes; knights and ladies they looked like, and pages and minstrels with lyres.

I'd never seen anything like it. Dicky had never thought of anything like that. I turned back and all the colors rolled into a point and vanished. The last I saw of them was like the flapping of a wine-red flag round Andy's head as she stood in the rain. I didn't know what to think and I certainly didn't know what to do but she started to laugh. And that lovely voice of hers, sort of hollow and warm: "Alan," it said, "you are a bloody fool. What did you say, you weren't *normal?* What's normal?"

She put her hand in my arm again. Now I thought about it I realized nobody had ever done a thing like that before. She started to walk, kicking her shoes on the path and steering me along, looking down at the ground then back up to me when she thought of a fresh thing to say. I can't remember the words she used, I've had to make the sense of them up out of my head. This was something like what she said:

"See the town. Think yourself in through all the little blinds and curtains, through the windows to the people there. Think what they're doing right now. Do you know what they're doing, Alan?"

"No," I said. Or I think I said. "No, I don't."

"They're dreaming, all of them. Gosh, dreaming so hard you can see the colors and the hotness coming out of all the house roofs like wobbling currents in the air. The town dreams, Alan. Just think of it. Forty thousand years of dreaming every twelve months. Everybody dreams, in all the towns, all over the world. How do you think they stay alive?"

"But . . ."

"Look close" she said. "Good heavens above, kings and ghosts and white squalls and mermaids! Such a flapping about. See the old dog there that's been dead these twenty years fetch a stick for its master. Can't you hear him bark? And a bus driver catching mantas, and a barber just back from Mars, and a little boy loving a brand new life. She wears grey woollies and she's got a head cold and bad legs but tonight she's Cleopatra—"

"Andy," I said. "I've just got to get back. My brother—"

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She stopped and did a sort of little skip on the path. "Your brother," she said, laughing at me. "Didn't you dream him too? Are you all that sure? Perhaps he was your Id. You know, all dark and welling and gruesome."

"That's crazy," I said. "It wasn't like that." But you know, the more I thought about it the more I wasn't sure whether she was right or not. She was still laughing at me. "You thought him up as well," she said. "You'll find he isn't there any more. You've just got a little old empty house to sell. It was all dreaming."

That got me mad. I was really upset, I can tell you. "It wasn't!" I said. "We had a Talent. We got it from our folks, you've got it as well. See, I'll show you." I stared at a lamp post. I was going to make it grow into the great ziggurat of Babylon, all its terraces green with trees, but . . . it wouldn't work! I tried again, puffing, but nothing changed. Nothing altered at all. I started to dance about a bit at that because I could see I was stuck in the most terrible Possibility of all, the one we live in. Andy shook her head sort of sorrowfully.

"It was all dreaming," she said. "When you don't need a Talent any more, it dies."

She walked a few paces away and turned and waited. I worked myself to a standstill on that bloody lamp but it stayed just like it was. I leaned my hands on the wet green iron and looked at Andy, her untidy hair and the mac collar still half up and half down and her slim ankles and the rain dimpling on the path round her feet. Then I started to walk toward her because whatever happened I didn't want to be left alone right now. And it was funny but before I reached her I'd stopped worrying about the Talent. It seemed I didn't need it any more. The whole dark street was enchanted, and the rain-spots shone like jewels. END

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Delivery Tube

by JOSEPH P. MARTINO

Illustrated by GAUGHAN

The Micronesians were building something—but what? He only knew it endangered the world!

I

The name Harold Michelson stared back at him from the nameplate in his hands. His glance moved from the backs of his hands, once well tanned but now showing an office pallor, to the Germanic script of the nameplate. He had had it hand-lettered by one of the last of a dying generation of craftsmen during a six-month's stay in Dresden, back during the days when it was still safe for him to visit Eastern Europe. All in all, his stay in Dresden had been a relaxing interlude in an otherwise hectic life. His thoughts drifted slowly through Dresden like the coal barges on the Elbe. Suddenly he jerked his mind back to the present. Daydreaming about the past wasn't going to solve his problem of the here-and-now.

He turned the nameplate about and gently placed it back on the desk. He then picked up the sheaf of photos which was neatly stacked in the center of his blotter. For what must have been the thousandth time he stared at them, as though by in-

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tense concentration he could force the photos to make sense. They weren't really bad pictures, considering that they were taken with a long-focal-length lens, from the deck of a submarine surfaced just outside the twenty-mile-limit claimed as territorial waters by the Republic of Micronesia.

The top photo showed the narrow entrance to the harbor of Jingjok, capital of the Republic, with its protecting ring of mountains whose gentle slopes revealed their volcanic origin. The photo also showed, on the seaward side of the mountains, a row of openings which might have been caves or mine entrances. The remainder of the photos were blow-ups intended to show more details of the interior of the openings. The photos had been shot at dawn, with the sun shining directly into the openings, in order to provide as much detail as possible.

They had evidently been taken just in time. Some of the openings were already closed off by heavy doors, and similar construction was evidently under way on the rest of the openings. Even another week or two might have been too late. Not that it made that much difference. What the pictures revealed of the interior of the caves, mines, or whatever was even more baffling than their existence had been originally.

The first thought had been that these were gun emplacements for coastal defense guns. To the archipelagic Republic of Micronesia, with its 3,000 islands sprawling across forty degrees of longitude, control of the seas was an almost instinctive demand. Coastal defense guns made a great deal of sense, particularly to an intensely nationalistic country of limited technological capabilities. Coastal defense guns could be manufactured and maintained by a comparatively primitive economy. Jet bombers and missiles came as gifts from major Powers; they came with strings attached, and spare parts could always be cut off or the technicians brought home, leaving the recipient with a collection of non-weapons.

However, what the pictures showed certainly didn't look like guns. They appeared to be nothing so much as derricks. While the illumination inside the openings was inadequate for a really clear picture, the appearance of trusswork and cables was unmistakable. To confuse the issue further, the preposterous structures seemed to be mounted on flatcars.

With a sigh, he dropped the first pack of photos, and picked up another.

These seemed to support the flatcar hypothesis, but dealt another blow to the coastal defense gun theory. These photos, taken from a satellite directly above Jingjok at local noon, showed a ring of similar entrances completely around the city, on the landward side as well as the seaward. While the photos of course showed nothing of the interior of the openings, they did show a short length of railroad track leading out of each one. In addition, a network of roads led from each construction site and converged, on the landward

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side, to what a photo of the adjacent area showed to be a small industrial complex, including a blast furnace and several buildings which appeared to be foundaries.

This industrial complex had been kept under observation, via satellite camera, over a period of several years. It had started out as a single building inside a triple barrier of barbed wire. From time to time the barriers had been extended, and new buildings put up on the additional space. Approach to the area on the ground was strictly controlled, and the Micronesian government never even admitted the existence of the area, which was a strong contrast with the publicity attending the opening of every other new factory in the Republic, which by now had included at least three steel mills and an oil refinery. Despite the existence of the other steel mills, a blast furnace had gone up inside the barriers about two years ago. Within the past year, several other buildings had gone up, including two with the characteristic high roofs of foundaries, and another with the tell-tale stacks of open-hearth furnaces. One of the foundaries turned out something which was long enough to require two truck-trailers to carry it.

Unfortunately the satellite cameras could not penetrate the canvas covers over the trailers. However, the cameras had spotted one of the double-trailer trucks near one of the mysterious openings in the mountainsides around Jingjok. And the loading dock behind the other foundary appeared to be full of prefabricated trusswork of some kind.

Clearly something was being manufactured behind the wires, and transported to the man-made caves completely ringing the capital, installed on flatcars, and then protected behind heavy (blastproof?) doors.

He had managed to deduce that much in the first hour of studying the pictures. In the next three days of alternately staring at the photos and asking questions of the information-retrieval computer, he had managed to come to no additional conclusions. The whirling circle of his thoughts was interrupted by the voice of his secretary on the intercom.

"Mr. Michelson, Mr. Anders wants to see you now."

"Thank you, Jean, I'm on my way." He scooped up the pictures, stuffed them back in the envelope labelled TOP SECRET, sidled between his desk and a file cabinet and left his cubbyhole of an office.

II

As he walked down the hall, with its paperboard walls painted in bilious Government Green, and its well-worn soft-wood floor, with the wide cracks between the floorboards that the pushbrooms of the janitors never did get clean, he reflected for the millionth time on the mysterious ways of Washington bureaucracy.

Originally the CIA had been set up to consolidate all the intelligence activities of the United States. In the subtropical climate of Washington, however, new agencies seem to spawn like fungus. So it was not long before a host of specialized in-

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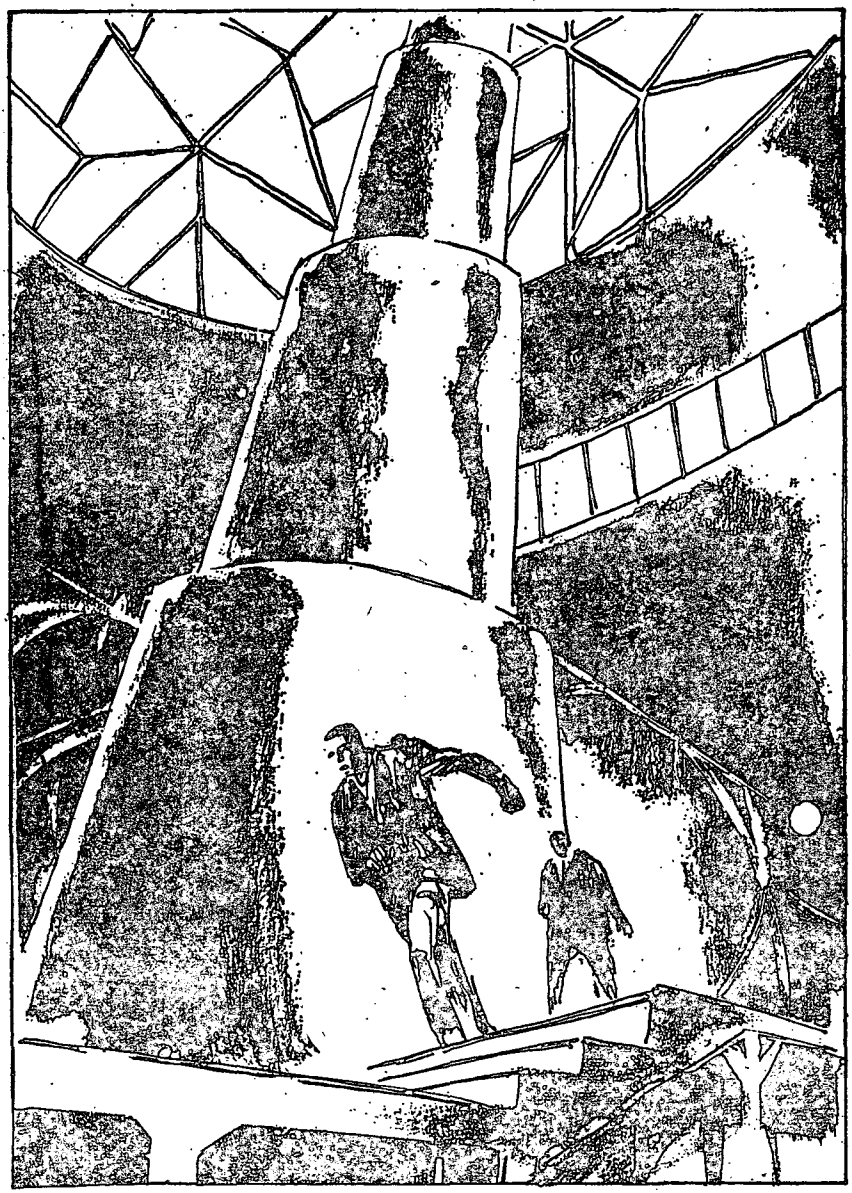

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telligence agencies had been formed to supplement the CIA. Most of them as uninformative as that of his own agency, the Special Services Agency. He supposed that eventually another super-agency would have to be formed to consolidate these new ones, since no one would be willing to admit they should have been incorporated in the CIA in the first place. In the meantime, the chief drawback to working for the newer agencies was the fact that, while the CIA had graduated to a magnificent steel-and-glass edifice out in the Virginia suburbs, the newer organizations like the SSA still had to serve their apprenticeships in the World War II temporary buildings which, twenty-five years later, and despite the efforts of five Presidents, still disfigured downtown Washington.

He turned and entered his boss's office. As befitted a Branch Chief, his office was twice the size of those of his subordinates, which meant he could get out from behind his desk without having to squeeze past a file cabinet.

"Good morning, Mr. Anders."

"Good morning, Harold. Have a seat. Made any sense out of those pictures yet?"

"Yeah. They're putting derricks in those holes. When the Commies get tired of playing games with Premier Akandro, he and his cabinet will hide there and use the derricks to pull the holes in after them."

"Well, that explanation makes as much sense as any other I've heard. However, I hope you can do better than that after you've been on the spot for a while. We're sending you to Micronesia to see if you can find out what they're up to."

"I've been suspecting you had that in mind. I don't mind going there. It certainly would be a change of scenery. But let me remind you that my specialty is Common Europe. I know nothing about the Republic of Micronesia except what I read in the newspapers, and I don't believe most of that."

"The reason you're going instead of someone else is simple. There's pressure on from the top to get an answer quickly, and you're the only industrial espionage man we have available right now who speaks fluent French. You'll want to review our Area Files to give yourself a complete picture of the country, but I'll give you a capsule summary now.

"As you ought to know, Micronesia was a French colony up until World War II. It was in a sort of limbo, giving grudging allegiance to the Vichy government, until the Japanese took it over in 1942. The Japanese granted the Micronesians their independence in 1945, just before we and the British occupied the place in the name of the French. The Micronesians had set up a government under the Japanese, which continued to function throughout most of the islands while the French reclaimed a few of the more important cities. When the French decided they couldn't afford to fight a war in Micronesia as well as in Indochina, they pulled out and left the Micronesians to their own devices.

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"Premier Akandro has been an active nationalist since the 1920's, and spent quite a few years in various French jails before the War. He was the first Premier of the independent government which took over from the Japanese, and under one title or another, he has run the country ever since. Although he has tremendous personal popularity with the people, he has no established constituency or power base. This has allowed him to stay aloof from the ethnic squabbles and political infighting which are continually going on, but it means that no political party can lay claim to his program, and no politician is an obvious heir. In principle, all political parties have been abolished, but most of the old-time nationalist parties have maintained a shadow organization. However, most of them are based on narrow ethnic or economic groups. The Communist Party is the only one which is well organized on a national basis. This means there is inevitably going to be a power struggle when Premier Akandro dies, if not before, and the Communists are best set up to win it.

"When the Micronesians held one of their periodic celebrations of Stone-the-American - Embassy - Day last year, we reduced our Embassy to a Consulate, with a two-man staff. This meant that all the CIA agents came home, and their nets among the Micronesians disintegrated. Our Special Services Agency nets are based on the Taiwan-supporting Chinese community, which is being hurt by the Premier's campaign to break the Chinese monopoly of small business and commerce. Three of the more broadly based nationalist parties accept financial support from the Chinese, most of which actually comes from us. The real purpose of our nets is to assist the nationalists when the power struggle starts. We provide financial support now to keep them going, and we can provide arms when they are needed. Unfortunately, our Chinese nets don't seem to do us any good towards finding out what's going on inside that barrier. The Chinese won't do manual labor, and of course they can't recruit any of the Micronesian workers who are already working inside there. So we hope you can do better by being on the spot.

"You will use your usual cover of free-lance journalist. As usual, we've arranged to have a national magazine publish an article by you on Micronesia, to help maintain your cover. You will interview the Premier, and members of those three parties we support. We can also give you the names of the contacts for the old CIA nets. Think you can handle it?"

"I'd feel a lot better about using agents and nets I'd developed myself, but I'll give it a try. It all hinges on the willingness and ability of those Micronesian nationalists to penetrate that factory complex and those holes in the mountainside, and identify what's going on for us. Can those parties recruit any of the workers now in the restricted area?"

"It's not too likely. They are based in the outer islands, and have never been successful in recruiting mem-

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bers from around Jingjok. However, they keep trying just on general principles, and may have had some success. Better look into that. Now there's one other thing."

"What's that?"

"Keep in mind that your mission is to find out what's going on inside that mountain. However, we do have another puzzle. Three months ago Premier Akandro announced that the Republic of Micronesia would soon have its own nuclear weapons. It was hard to believe, so we didn't give it much credence. However, we checked anyway. We found that the Congolese People's Republic had sold Micronesia a considerable quantity of uranium ore. A group of Czech chemical engineers had gone to Micronesia, ostensibly to set up a sugar refinery, but the Czechs are home already, and there has been no announcement of a sugar refinery opening. A couple of West German experts on centrifuge operation are known to have spent some time in Micronesia within the past year. And a group of Micronesian physicists, who are known to have studied nuclear physics in Prague, made an extended visit to Red China about six months ago. So clearly the Micronesians have uranium ore. They undoubtedly have a refinery to produce the pure metal and a centrifuge in operation to produce weapons-grade U-235, and their physicists have been taught by the Red Chinese how to make nuclear weapons."

"Wouldn't they have to test their weapons? I'd never trust any weapon someone gave me. I'd certainly put one together and try it."

"Even if someone showed you calculations, based on theory you already knew and believed, that the weapon ought to work?"

"That's just the point. The theory isn't enough. Nowadays any half-baked nuclear physicist can calculate a critical mass, which if assembled will explode after a fashion. But that's still a long way from having an efficient explosion, with a respectable yield-to-weight ratio. Not only that, but a major part of the design of nuclear weapons involves making sure they go off when you want them to, no sooner and no later, and particularly not when they undergo any reasonably predictable accident. There's an awful lot of technology that goes into nuclear weapons that just doesn't come out of theoretical nuclear physics. It comes from mechanical and electrical engineering, and a lot of it is cut-and-dry. And test explosions are a necessary part of the process."

"That was the official conclusion too. And the final piece of the puzzle was a test explosion the Red Chinese had fired off while those Micronesian physicists were in China. It was a uranium bomb of only around fifty kilotons, a fairly low yield compared with what the Red Chinese had been testing regularly. It was doubly surprising because we knew most of their weapons inventory was plutonium bombs. Looking back, the official conclusion is that the Red Chinese taught the Micronesian physicists how to make a uranium bomb, and the Micronesians built one according to the Chinese design, and fired it on the Chinese test

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range. They can now go into mass production of a tested bomb design in which they have considerable confidence. If they ever want to build an improved model, of course, they'll have to find a way of testing it."

"But so they've got a bomb. What will they use for a delivery system? A bomb's no good stored in your arsenal. Even if you just want to use the thing for threats, you can't do it unless the people you're threatening believe you can deliver a bomb if you want to. Their handful of Mig 23 interceptors is not a credible force, even if they do figure out a way to hang a bomb on them."

"Now you've come to the heart of the matter. We don't know what they could possibly use for a delivery system. It's just possible that they've learned from someone how to make missiles. If so, the missiles may well be being built inside that secret compound, along with the other things they make there and don't talk about. So if you manage to get an agent inside the place, have him keep his eyes open for anything that looks like a missile."

"Okay. And I'd better get busy boning up on Micronesian history, culture and geography."

III

The International Waiting Room, perched atop the terminal building at the Jingjok International Airport, gave an unobstructed view toward the horizon in all directions. He decided he might as well enjoy the view, while the customs and immigration officials performed their mysterious rituals with his passport and luggage.

At least one could take comfort in knowing that the delay was due solely to bureaucratic inefficiency. For all its other faults, the government of the Republic of Micronesia had been successful in stamping out bribe-taking by its officials. So there was no hope of speeding up things by slipping a hundred-rupi note inside his passport.

He wandered over to the nearest window, and looked out at the airport, glaring white under a blazing tropical sun. There, parked on the ramp, was the Tupolev Tu-15 supersonic transport, operated by Air Micronesia, which had carried him from San Francisco. He had welcomed the chance to ride one and was pleasantly surprised to find that it was even more comfortable than the Concordes which dominated the North Atlantic routes.

He turned and strode to the other side of the waiting room.

The ring of extinct volcanoes which surrounded the city of Jingjok and its harbor seemed near enough to reach out and touch. The land between the airport and the city showed the orderly patches of intense cultivation. The flat lowlands were covered with the uneven rectangles of paddy fields, showing the yellowish-green of maturing rice stalks, while the rich volcanic soil of the mountains was covered with the darker greens of tea plantations and stands of rubber trees. According to the guide books, the view from the top of the mountains was even more beautiful, and highly recommended.

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His enjoyment of the beauty was ended, however, by the sight of the raw earth showing through the greenery on the mountain sides, where roads had been hastily bulldozed through the plantations, and tunnels driven into the mountains.

He heard his name called, and hurried to pick up his luggage and passport at the desk in the center of the room, then rode the escalator down. As he stepped off the escalator a flash bulb glared in his face.

"Want your picture, sir?" asked the broadly smiling photographer as he started to pull the photo out of his instant-developing camera. Michelson brushed past him, thoughts whirling rapidly. The chance that the man was a legitimate street photographer was almost vanishingly small. The fact that the photographer had spoken to him in English instead of French or Russian could be written off as a clever deduction from Michelson's clothes and luggage stickers. But who was the man working for?

The most logical outfit was the Micronesian Secret Police, and this could be considered a routine step toward building up a dosier, since they knew he was coming anyway. Furthermore, there was no reason to believe that the Micronesians had penetrated his cover. While the Russians had penetrated his cover in Europe, a fact which restricted his efforts to the area west of the Iron Curtain, there was no reason to believe they had passed the information on to the Red Chinese. Furthermore, he doubted that the Red Chinese had penetrated his cover on their own, since he had never operated in the Far East or South America. Thus while the photographer indicated that someone had at least a routine interest in him, that fact did not appear to present an immediate danger. In any case, there was nothing he could do about the picture without calling even more attention to his arrival.

As he walked to the taxi stand, he spotted a heavy-set man getting out of a cab. He suddenly stopped, turned around, and busied himself with his luggage and papers. He was certain the man he had spotted was Alexei Suvarov, of the Russian industrial espionage section devoted to Common Europe. Michelson considered Suvarov to be his opposite number among the Russians. The two had met on several occasions. Michelson had survived the encounters, but unfortunately so had the Russian. And what was he doing in Micronesia? Surely not taking a vacation. Did he have some connection with those holes in the mountainside?

Michelson took the first cab, and directed the driver to the Independence Hotel, whose cuisine reputedly retained much of the excellent quality it had had when it was known as the Maison Coloniale. When he checked in, he found that there was a message waiting for him. The Minister of Information was pleased to inform him that his request for an interview with Premier Akandro had been granted. He was to present himself at the Premier's office in the Hall of Parliament, on the Victory

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Plaza, formerly the Palace de la Concorde, at two P.M. on the morrow.

With his ostensible business under control, and the afternoon before him, he decided to get his first visit to the Chinese quarter out of the way. A taxi took him to the Liberation Monument, where a heroic statue of an armed Micronesian peasant had displaced a statue of an obscure French general. From this point a street, still named Rue Pasteur, passed through the Chinese district on its way to the waterfront. The street was lined on both sides with shops and restaurants displaying signs bearing Chinese characters, in addition to the usual French and Micronesian signs.

He walked, apparently without purpose, down one side of the street, looking in one shop window after another. One shop had an interesting display of bronzeware, apparently hand-made locally. He walked in, and a young Chinese woman stepped through a curtain of beaded strings which hung across the rear door.

He pointed to an attractive bronze letter opener which had a handle of black buffalo horn, inlaid with mother-of-pearl. "How much?"

"Twelve rupis, sir."

"Although it is very beautiful, that is too high a price. I offer eight rupis."

"Consider the amount of hand workmanship on the handle, though. Your offer is too low. Eleven rupis."

After some more haggling, he ended up with the letter opener for ten rupis, and a bronze Buddha for fifteen.

He wandered farther down the street, twice entering shops, haggling a little and walking out without making a purchase. Stepping out of the second of these, he looked down towards the waterfront, glanced at his watch, then crossed the street and headed back toward the Liberation Monument. He continued to drift along, examining each shop window as he passed. He studied the display in the window of a shop which bore an immense dragon on its sign, and the name Sin Hwang in gold letters over the door. Abruptly he stepped inside.

He spoke to the clerk, an alert-looking young Chinese man. "I wish to see some jade figurines, please."

"Men or animals, sir?"

"Animals."

"Come this way, please." The Chinese led him through the inevitable curtain of beaded strings and down a short corridor to an office, where an elderly, bearded Chinese sat behind a desk.

"This man wishes to see jade figurines of animals, revered grandfather."

"Thank you. Please bring us some tea, and I will show him our wares." Then after Michelson's escort had gone. "The road is long, is it not?"

"Yes, and full of turns."

"Well, I hope you took enough of those turns to throw off any of Akandro's secret police who may have been following you."

"I think I shook off any tails that they put on me. If not, they got a pretty boring tour of the local Chinatown. How many of Peking's

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boys keep an eye on your shop, though?" Then he related the incident of the photographer at the airport.

"I had not heard about the airport photographer before. This is something new, within the last week. The Micronesian secret police normally receive two copies of the photograph which is submitted with your visa application, and pass one along to the Peking branch of the Communist party. Therefore neither of those groups would have reason to take your picture. Perhaps it was the French? They are eager to detect the slightest trace of American influence in Micronesia. And as for this shop being watched, we must assume that it is. While the followers of Peking do not know that I am a Kuomintang supporter, they suspect anyone who does not work with them. That is why you should not stay here long."

At this point the young Chinese came in with a pot of hot tea and two cups, set them down on the desk, and left without a word.

"This Micronesian tea is not as good as that which comes from Taiwan, but with the tariff that is levied on imported tea it is all we can afford. Now, what can I do for you?"

"I want to make contact with the appropriate members of the Smallholder's Party, the Baluntan People's Party, and the Independent Radical Party. My main interest is to find out what is going on in those holes that are being dug in the mountainsides around the city."

"You will have to use your own overt means for contacting the leadership of those Parties and arranging interviews. However, I will send messages through couriers that your are more than just a journalist, and that you in fact come from the American SSA. You must remember that ostensibly we support these Parties only because we share with them a mutual interest in opposing certain actions of Premier Akandro. They would resent any suggestion that we might give them orders. In actual fact, they accept SSA support only to the extent that such support coincides with their own desires to maintain Micronesia free of Communist domination. They are in no sense pro-American. In the case of the Smallholder's Party and the Independent Radical Party, our contacts are the party leaders. Thus you would want to interview them anyway. In the case of the Baluntan People's Party, our contact is the Assistant Party Secretary. However, the Party Secretary is visiting the Island of Baluntan now, and will not be back for a month. So it would be entirely reasonable for you to interview his assistant."

"Very well. I have the names and addresses of these officials, and will get in touch with them through normal means."

"I suggest you send telegrams. The Postal Telegraph Service charges very low rates, and in fact it is quite customary for all important messages between persons living within Jingjok to be sent by telegram. Since we do not have the extensive telephone system of more advanced countries, the telegram serves

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us almost as well. Now, here is a carved jade dog. I suggest that we agree on a price of seventeen rupis, and that you be on your way, before it occurs to anyone to wonder why it is taking you so long to make a purchase in here."

IV

The next day Premier Akandro kept Michelson waiting only 15 minutes, the bare minimum he could keep a representative of the imperialists waiting and still maintain his standings as a neutralist. Michelson entered the Premier's office, to find him seated behind his desk, and wearing the plain white uniform which symbolized the austerity and dedication he claimed for his administration.

"Good afternoon, Mr. Michelson. Please be seated. The time I can give you today is very short. Since you did not submit written questions in advance to the Ministry of Information, the answers you get may not be as detailed as you desire, but I will answer you as fully as I can in the time available."

"Thank you, Your Excellency. I did not submit questions because I am more interested in conveying to my American readers a general impression of you and the aims of your Government, rather than the answers to specific questions. Since it will be several weeks before my article will appear, the details of topics of current interest are of little value to me. First, you claim to follow a policy of neutralism in world affairs. What exactly do you mean by neutralism?"

"Yes. To be neutral implies two groups to be neutral between. In the world today there are two such groups. One, which generally refers to itself as 'the West', is led by the USA, England and France, the major imperialistic powers. The other group is led by the Union of Soviet Socialist Republics, and the People's Republic of China. This latter group, in its emergence from feudalism and subjection to the imperialists, and its attempt to take its rightful place in the world order, encounters resistance from the older, established powers of the West. The resulting conflict is known as the Cold War. We feel that neither side in the Cold War has any legitimate interests to be defended in Micronesia, thus we feel that our Republic should not be considered an arena for the Cold War. More generally, we do not feel that any of the nations of Asia, Africa or South America which are emerging from feudalism, and gaining their independence from the imperialists, should become involved in the Cold War. This is what we mean by a position of neutralism."

"That was a very clear description of your position. However, many Americans feel that in practice your neutralism means to be neutral in favor of the Communists. Would you care to comment on that?"

"If that is true, you have only yourselves to blame. What has been our experience at the hands of the West? For over one hundred years the French imposed their rule upon us and exploited us. After the Japanese granted us our independence,

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the British and the Americans attempted to help the French reestablish their rule here. You refuse to sell us the weapons we need to defend ourselves against the imperialists. You will not grant us aid unless we agree to follow your lead in world affairs. You attempt to establish a form of neo-colonialism by urging us to allow foreign capitalistic investors to exploit our resources. On the other hand, the Soviet Union and China support us against the imperialists, they give us weapons, they build factories for us, and they have never controlled us nor attempted to control us. Why should we not be neutral in their favor?"

"Another question, now. What do you consider to be the role of Micronesia in the world, and among the neutralist nations? Do you consider yourselves as a leader of the neutralists?"

"Remember that in population the Republic of Micronesia is already the world's fifth largest nation. Our vast resources make us potentially one of the wealthiest nations in the world. It is only natural that we should be one of the leading nations in the world. Instead of thinking of ourselves as leaders of a neutralist bloc, however, we consider ourselves to be leaders in the struggle against imperialism and the exploitation of the emerging nations by the older nations of the West."

"You have announced that the Republic of Micronesia will have its own nuclear weapons. Do you believe this will enhance your role in world affairs?"

"We feel strongly that the possession of nuclear weapons will gain us more respect. The West still thinks of us as we were during the period of colonial exploitation. We are considered hardly competent to manage our own affairs, a backward nation, little better than savages. Our voice will be considerably stronger when backed up by nuclear weapons. However, I wish to add that we are not depending upon nuclear weapons alone to gain us prestige. Other accomplishments of our scientists will also make the world pay us more respect. In fact, tonight I will make an announcement, on a national television broadcast, of an impending major accomplishment. I cannot give you any details now, as my countrymen have a right to be the first to know. However, I will instruct the Ministry of Information to provide you with exactly the same information all reporters will receive, at the start of the broadcast. It will be delivered for your convenience at your hotel room."

"Thank you for your consideration. Now you mentioned 'other accomplishments'. Does this imply that you will make your own nuclear weapons, rather than buy them? And if so, will you test your weapons underground, or are you planning to withdraw from the Test Ban Agreement?"

"Yes, we will make our own weapons. However, we see no need to retrace the paths others have followed in the development of weapons. Many nations already know how to make nuclear weapons. We have bought the knowledge from one

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of them. It took much less time and money than our own development program would have. We will not need to do any testing."

"Is one of the accomplishments of your scientists the development of a delivery system for your weapons?"

"We will have a delivery system."

"I see. And does one of their accomplishments involve the construction work going on outside the city, on the other side of the mountains? This morning I tried to take one of the advertised tours up to the mountaintop. Three travel agencies flatly turned me down, and when I called the Ministry of Tourism, I found that the area has been closed off at the orders of the Ministry of Defense."

"At the appropriate time, the purpose of that construction will be revealed. And now, I have given you all the time I can."

As the Premier stood up behind his desk, Michelson rose also. "Thank you for your candid comments, Your Excellency. I shall be looking forward to your announcement tonight."

Well, he thought, as he returned to his hotel, that went just about as expected. Premier Akandro views the world not only from the latitude and longitude of Jingjok, as should be expected, but through the spectacles of hypersensitive nationalism as well.

He hadn't really expected to get any useful information. In fact, asking about that construction involved some risk, but failing to ask about something so obvious might have involved more risk. In any case, the whole point of the interview had been to protect his cover. It certainly would not do to obtain interviews with the heads of several out-of-power minority parties, and not ask the Premier for an interview.

When he reached his hotel, he found that his suggested appointment with the Party Chairmen of the Smallholder's Party and the Independent Radical Party, for the morrow and the day after respectively, had been accepted. The Assistant Party Secretary of the Baluntan People's Party had wired back tentative acceptance for a time an hour later than he had originally proposed. He dispatched a telegram accepting the revised appointment, and decided to take a walk before dinner. He arrived back at his room well before the scheduled start of the Premier's talk. He wanted to make sure the television set was working, and make other arrangements if it were not. The Republic of Micronesia, like many other new countries, had realized the potential of television for educating and indoctrinating the citizenry, and was not about to waste such a valuable and powerful tool on mere entertainment. Thus Michelson had not bothered to turn the set on since he had arrived. He turned it on and switched to the French channel, where a simultaneous translation of all official announcements was provided. He found the set in working order, turned the sound down, and sat down to wait for the Premier's talk.

Just before eight o'clock, there

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was a knock at the door. He opened it, to find a young man in an austere white uniform, worn in emulation of the Premier, carrying a large envelope under his arm. "I have been directed to give you this press packet as soon as the Premier starts his talk. May I come in?"

"Yes. Please sit down. I have the television on already."

Michelson strode to the set, and turned the sound up. ". . . an announcement by Premier Akandro of great importance to the Republic of Micronesia and to the world." The announcer's face disappeared from the screen, to be replaced by a view of Premier Akandro, seated at his desk in his office, and wearing his perennial uniform. The Premier stared at the camera for a few seconds. A vagrant thought crept through Michelson's mind about the number of identical uniforms the Premier must have. He conjured up a picture of the Premier's official residence, filled with rack after rack of plain white uniforms.

The Premier broke the spell with his standard opening.

"Fellow citizens." At this the functionary rose, handed Michelson the envelope, and left silently. "Our Republic is at last receiving the recognition due its status as one of the great powers of the world. As I told you previously, soon we will no longer have to depend upon our friends to defend us against the imperialists. We will have our own nuclear weapons. However, we do not wish to present to the world the appearance of being a war-monger, always brandishing our weapons. Therefore I am pleased to be able to announce to you the next triumph of our scientists and engineers. We will soon send up our own sputnik. Ours will not be for the purpose of spying on other nations, as are the sputniks the Americans send up. Instead, ours will make scientific measurements of conditions in space. These measurements will be made for peaceful purposes, and will be made freely available to scientists all over the world. This peaceful triumph of our scientists and engineers is of course made possible by the work and sacrifices you, my fellow citizens, are making for the growth and development of our Republic." At this, he stood up behind his desk, and the strains of the Micronesian National Anthem blared from the speaker. At the completion of the Anthem, the Premier's picture faded from the screen, to be replaced by an announcer.

"Fellow citizens, the Minister of Science will now present to you the details of the sputnik to be launched by the Republic of Micronesia, which was announced by Premier Akandro."

Michelson reached for the set and turned it off, realizing that he already had, in the press packet, all the information the Minister of Science was going to provide. He opened the envelope and spread the contents out on the floor. There was a copy of the Premier's address, several glossy photos of a satellite-looking thing, an outline drawing showing various views of the object in the photos, and a description of the

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experiments to be made. He turned to the experiment list first. The satellite would measure the energy spectrum and flux of protons in the range 1 to 100 mev. perpendicular to the geomagnetic field. It would also measure total proton flux in the same energy range. It would measure omnidirectional electron flux in the range 0.3 to 3.0 mev., and electron flux above a 40 kev. threshold both parallel and perpendicular to the geomagnetic field.

Just on the face of them, the experiments did not sound impressive. This type of measurement had been made time and again already. However, most of the people in the so-called neutralist world would not be aware of that. Successful launch of such a scientific satellite would clearly improve the Micronesian image in many parts of the world, and make dealing with Premier Akandro even more difficult.

Furthermore, the experiments themselves were chosen cleverly from another standpoint. They were difficult enough to give a fledgling instrumentation laboratory a real test of its ability, but not so difficult that there would not be reasonable confidence of success from the outset. He turned next to the photos. The satellite looked like a long, thin cylinder. It had a rocket engine on one end, and a turnstile antenna on the other. The outer surface appeared to be covered with solar cells. Midway between the two ends of the cylinder there appeared to be a ring or collar, concentric with the satellite's skin, and supported by several spokes. He turned next to the line drawings, which showed the size of the satellite. Weight was 450 kilograms. Overall length was three meters, and the outer diameter of the collar was 75 centimeters.

He pored over the plans for a while, finally dropping them on the floor and leaning back in his chair, with his fingers interlocked behind his neck. The satellite represented a nice piece of design, from choice of experiments to implementation. But it didn't make any sense? How did they plan to get the thing into orbit? They might have made an agreement with some country possessed of boosters to launch it for them, but that didn't square with the emphasis on its being an all-Micronesian product. But then what would they use for boosters? A satellite without a booster had no more sense than did a stockpile of nuclear weapons with no delivery system. And what, if any, connection did either the weapons or the satellite have with those holes in the mountainside?

Despairing of coming to any conclusion, he decided to go to bed. Perhaps the interviews with the nationalist party leaders would be more illuminating.

V

Ali Sastrom, Party Chairman of the Smallholder's Party, had met Michelson at a small office which was still maintained by the Party, despite its official dissolution some years earlier. He suggested to Michelson that they go to a restaurant for some coffee while they talked. When they arrived at the

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restaurant Sastrom had selected, they were ushered to a small cubbyhole away from the dining room. The proprietor brought them a pot of thick black coffee, two cups, and a can of sweetened condensed milk, bearing a British trademark. Sastrom showed Michelson how to float the thick, syrupy milk on top of the coffee, then ended the flow of small talk he had maintained since leaving the office.

"We can talk freely here. The proprietor is a trusted member of the Party, and maintains this room as a secure meeting place for us. The Secret Police have not discovered it, let alone planted listening devices in it."

"Good. You have been informed of the nature of my visit here?"

"I have been informed by Sin Hwang, the Chinese merchant, that your appearance as a journalist is only a cover, and that you really represent the American agency which supplies us with funds. I know no more than that."

"Then his courier did reach you. Good. I will publish an interview with you, so we had better agree upon some views which won't get you in trouble."

"Fine. I have already prepared a written statement of our Party's views on a number of subjects, which you can work into your article. Here it is."

"Thank you. I hope it's more publishable than the interview I had with Premier Akandro."

"Aarrrgh! Akandro!" Sastrom fairly spat.

Michelson was startled at the vehemence of the reaction. "Look, I spend most of my time in Europe. I know very little about the politics of this area. But I thought Akandro was a national hero."

"That's right, he was. If he had died right after we got our independence, or even as late as ten years ago, he would have been revered as a great patriot and leader. Our history books would speak of him as yours speak of George Washington. He and I are about the same age, but when I was a young man, I already looked up to him as a leader in the fight for independence. He was a well-known leader while I was still trying to organize the small farmers of my home district. He had already served a jail term before the French considered me worthy of their notice. And the way he held the country together, after the Japanese left and we were trying to stay one step ahead of the French, was magnificent."

"Then what happened to him?"

His voice dropped to bare audibility. "I wish I knew. Perhaps power has gone to his head. But he no longer seems concerned about the Micronesian people. He is more concerned with his own international prestige. He tries to be a world figure. He meddles in problems which are none of his business. Satellites! Pah! What our people need are agricultural experiment stations, rural cooperatives, credit unions to get them out of the hands of the money-lenders, better roads to get their crops to market. Instead, their taxes go to subsidize the foreigners

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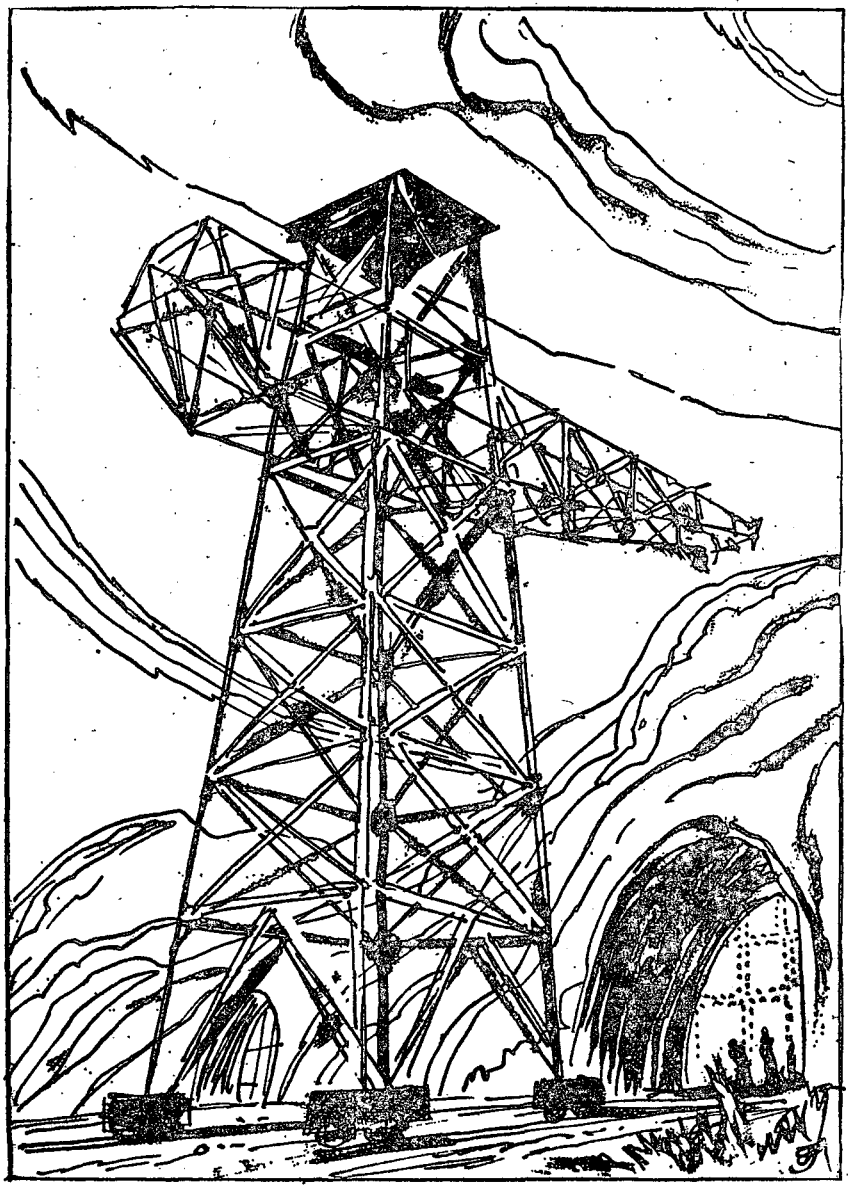

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who ride our supersonic transports. All in the name of prestige! And the Communists! They feed his vanity. They give him tanks for his army, submarines for his Navy, jet planes for his Air Force, so he can strut about like the leader of a powerful nation. They proclaim him to be an anti-imperialist hero. They pretend to consult his opinion about affairs in East Asia. In return he serves their purposes by making constant preachments about an imperialism which has been dead and gone for twenty years. And all the while they profit by his neglect of his own people. The grievances he ignores, the Communists promise to cure if only the people will join their Party. And the other parties can do nothing. If we attempt to imitate the Communists and recruit members, the Secret Police will suppress us completely."

"Do you feel that you will be able to keep the Communists from taking over completely in Micronesia?"

"We believe we can. It will not be easy, since the Communists would probably win any election conducted today. But with your continued support, for which we are very grateful, it should not be impossible."

"You realize, of course, that our support is not based on sheer altruism. It is very important to us that a populous and potentially rich nation such as Micronesia should remain out of Communist control."

"We realize this. You support us because to a certain extent your interests and ours coincide. But it must be remembered that we are not your tools. Where your interests and ours do not coincide, your support does not give you any right to dictate our policies."

"We have no desire to make puppets of you. But I wish to point out that there may be other areas in which our interests coincide. For instance, you yourself said that Premier Akandro has a tendency to meddle in things which are not his business. It could happen that, as a result of his meddling, we would be forced to take actions which would not be in the best interests of Micronesia. It would be in your interest if you could help us to forestall the need for such actions."

His voice took on a wary note. "What kind of help do you have in mind?"

"Well, for instance, consider all the construction work which seems to be going on in the mountainsides just outside Jingjok. It appears to have a military purpose. Would it be possible for you to get someone into the restricted area, to learn something about what is going on?"

The reply was toneless. "It would not be possible."

"Well, would it be possible to get some information about what is being made in that secret industrial area southwest of the city, and being installed inside the mountains?"

This time there was a distinct chill in the voice. "It would not be possible."

"Can you help us in any way to find out what is going on there?"

"Attend, Mr. Michelson. I am willing to admit the possibility that you and we might have mutual interests in making Akandro mind his

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own business. But those holes in the mountains are none of your concern, you will be told all about them. In the meantime, you should keep your spying nose out of them."

"Since you deny that your interests and ours coincide in the matter of that military construction, am I to conclude that your interests and ours conflict?"

Sastrom's voice calmed. "No, Mr. Michelson, I do not believe that there will be a conflict of interests. We have a saying that when the elephants fight, the grass gets trampled. Akandro thinks that those installations will make Micronesia one of the elephants, along with the USA, the Soviet Union and China. I do not think so. But I believe it will enable us to make the elephants do their fighting elsewhere, and not trample us into the grass. And perhaps they will allow him to lessen his dependence on the Communists. I hope so, anyway. In any case, if what we are doing there became known, there are nations which would try to stop us, using political or economic pressure, or perhaps even armed attack. Presented with a *fait accompli*, however, they will do nothing. So it is important that no one know what is going on until it is finished. And let me add that it will be of no use to threaten me with loss of your support if I refuse to help you in this matter. While your support is valuable, I will not compromise where the interests of Micronesia are concerned."

"I have no authority to make that threat. Nor do I think my superiors would carry it out. A non-Communist Micronesia is too important to us to risk dropping you. I presume this concludes our interview. Thank you for the coffee, and I had best be returning to my hotel."

VI

Michelson alighted from his cab in front of the Independence Hotel. His mood was one of complete discouragement. After three days of interviewing nationalist leaders, he was no closer to completing his mission than he had been in his office in Washington.

The men he had interviewed had differed only in the expletives they used to describe the Premier, and their list of major needs of the people, in which they tended to be biased by the interests of their respective Parties. They were, however, unanimous in their contention that the holes in the mountains were not a menace to the United States, and that in the best interests of Micronesia, no knowledge about them should be released until the construction was completed.

As far as his cover was concerned, however, he had enough publishable material to prepare a really prize-winning article about Micronesian politics. Come to think of it, he told himself, he just might be working for real as a free-lance journalist, if he didn't get some information about those tunnels. The SSA had a habit of replacing people who didn't produce.

He entered the hotel, and the bell captain beckoned him aside. They held a short discussion, then he paid

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the bell captain the previously agreed amount. He went up to his room, and stood just outside the door.

He pulled a fountain-pen out of his pocket, carefully removed the top, gave the plunger a quarter-turn, and held it with his thumb. He turned the key in the lock, kicked the door open, hurled the pen inside, and threw himself to the floor out of line of the doorway. He yanked another pen out, twisted off the cap and pointed it at the door. Suddenly a large revolver came sliding out the doorway and across the hall floor, to be followed by a red-eyed Alexei Suvarov.

Michelson pocketed the revolver and stood up.

"You did not have to be so violent, Harold. Had I wanted you eliminated, I could have had it done long before this. I wouldn't come to your room to do it myself."

"So you did know I was here. I wondered whether you spotted me at the airport."

"No, in fact I did not. But our photographer took your picture as a matter of routine, and I recognized that. Now I presume that pen of yours is much like the ones we use, and I would appreciate it if you would quit pointing it at me."

Michelson glanced down at the pen he was still holding, replaced the cap and slipped it back into a pocket. "The room should be pretty well cleared of tear gas by now, so let's go in."

They opened all the windows, then sat down. "How did you know I was here, Harold?"

"I see no reason to reveal my security arrangements, Alexei. After all, I don't know what you'll try next."

"Then let me guess. I bribed the bell captain to let me in, and no one else knew I was here. So you evidently outbid me, and that could have been done only by prior arrangement. So the bell captain not only took my money, but betrayed me anyway. I will have a delegation from the Micronesian Youth League call on him and explain the error of his ways. He will never again betray a representative of the working class. And that will knock out your security arrangements. Harold, you capitalists are far too prone to depend on the power of money. We Marxists depend on far more fundamental methods. Once we convince a man, money cannot buy him."

"Alexei, your goon squad might be able to convince someone that he'd better not betray you, but it will never convince him that a well-fed, well-dressed member of the New Class such as yourself is a representative of the working class. Now, since you claim you didn't come here to shoot me, what did you come for?"

"First, I presume your mission here is the same as mine?"

"Could be. What's yours?"

"I am supposed to be finding out what the Micronesians are digging holes in the mountains around Jingjok for."

"You mean you people don't know either?"

"Don't be so smug about it. Whatever the Chinese and the Micro-

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nesians are up to, I doubt that you'll like it any more than we will."

"You're certain the Chinese are involved, then?"

"We don't know the extent of their involvement, but they are involved somehow. Now what did you find out in your discussions with the bourgeois nationalists?"

"What do you have to trade for the information?"

"Very well, now we can get down to business. Are you familiar with this installation?" And Alexei pulled out a crude, hand-drawn map of the Micronesians' secret industrial area.

Michelson hesitated briefly, then decided that you have to trade information to get information, and he had precious little to trade. He went to a suitcase and pulled out a box of 35mm-projection slides and what appeared to be a common, battery-operated slide viewer. He selected one of the slides and placed it in the viewer. He switched the light on, and the viewer revealed a confusing array of blobs and blotches.

He went to another suitcase and returned with a small, black, truncated pyramid, which appeared to have a glass base and top. He opened the side of the viewer and slipped the pyramid inside, making sure that its alignment pins were fitted properly in grooves inside the viewer. The interior of the pyramid contained an optical fiber bundle, consisting of several million hair-like glass fibers, each capable of transmitting light from one end to the other by total internal reflection, almost like a tiny wave guide. The image of the slide fell on the top of the pyramid, and each picture element was transmitted by one single fiber to the base of the pyramid. If the fibers had all been parallel, the image they produced at the base of the pyramid would have been identical with that impressed on them at the pyramid's top. However, the fibers were woven in a very complex pattern, and the input image was completely scrambled at the output. Conversely, of course, a properly scrambled image would be reconstituted. In the language of the mathematician, the pyramid mapped one image into another. Furthermore, the mapping had the mathematical property of being continuous, which meant that if the input image were slightly misaligned, the output image would be recognizable but distorted. Michelson adjusted some micrometer screws to position the slide properly, and produced an image of the area shown in Suvarov's map.

"I see your satellite cameras are as effective as ours, Harold. I must congratulate you, however, on this ingenious method of carrying incriminating pictures. Now, do you see this building?" He pointed to one of the foundry-like structures. "Do you know what they are making in there?"

"No, I have to admit that we've never been able to get a look at the product. All our pictures show it to be covered with canvas. Other than that the product is long enough to require two truck trailers to haul it up to those tunnels in the mountains, we haven't any information.

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"I see. Well, I can tell you what they are making. They are making steel pipe. Not ordinary cast pipe, but thick-walled pipe built up in layers, like a cannon barrel."

"How do you know?"

"A shop foreman from Krupp, who was one of my agents in Common Europe, came out here several months ago to supervise the work. His move was made suddenly and secretly, and it took him some time to get in touch with me. I finally made it here, and have had two meetings with him. He says he has been making cannon barrels all his life, but he has never seen anything like this before. Who ever heard of a cannon barrel fifty meters long? Now the question is, what would anyone want with a fifty-meter tube, built up in layers? My agent, while an excellent maker of cannons, is not very imaginative. I feel that if I could get a close look at those things, I might be able to determine their use. Unfortunately, the security system inside the industrial compound is very elaborate. One pass is required to get inside the main gate, another pass to get into a specific work area, and a third pass to leave the compound. My agent has a pass for the building he works in, and an exit pass. However, a Secret Police agent escorts him in the main gate each time he enters, and he does not have a pass for entrance into the compound. I can have copies of his passes made at the Soviet Embassy, but that would still leave the problem of entering the compound. Thus I propose that we cooperate. If your nationalist friends can get us into the compound, my copied passes can then get us into the building, and out of the compound again."

"Why can't your Communist contacts get you inside?"

"The local Party is dominated by Peking. If they were willing to help me, I would not even need to enter the area. They could just tell me what is going on."

"Your offer is very intriguing, Alexei. I will see what I can do."

VII

Michelson had visited Sin Hwang, and engaged in some profitable discussion, this time emerging with a jade cat. His telegram to Suvarov had been answered, and they had met just before sunset at the Liberation Monument. They had walked through the Chinese district to the waterfront, where they had proceeded to a warehouse owned by friends of Sin Hwang. There they had been sealed into a crate, loaded onto a truck, then taken to another warehouse, and loaded onto another truck.

When this truck was finally on its way, Michelson opened some air holes in the side of the crate.

"That's better, Harold. It was getting quite close in here. But why all the rigamarole? Two warehouses, two trucks and all?"

"Just covering our tracks, that's all," he answered curtly. He had no intention of telling Suvarov that his contacts were Chinese, not Micronesian nationalists. Nor did he wish to describe the procedures by which the Kuomintang Chinese had deliv-

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ered him to a warehouse operated by supporters of the Chinese Communists. At each step of the way, every person who had anything to do with their crate could legitimately claim to have been following the instructions in the Micronesian Government's bill of lading which was fastened to the outside. The crate could be traced back to a pickup on the dock, where it appeared out of thin air. He added, "I should tell you that the driver of this truck works for the Chinese Communists. He doesn't know we're here, and we have to get off the truck without letting him know about it. This truckload of material is a daily shipment which the Micronesians have contracted for with a Red Chinese freight forwarding company. Incidentally, will your agent be there tonight?"

"No. His job was to teach the Micronesians how to build whatever it is they're making. He is finished, and in fact he left on this afternoon's plane to New Delhi, from where he will return to Germany directly. Fortunately there are other foreigners still involved in many phases of the operation, so that we will not appear out of place in the factory."

"Will it be in operation while we are there?"

"No. Initially they were operating around the clock, but most of the work appears to be finished, and for the past two weeks they have been operating only one shift daily."

"Good. That way we won't have to explain our presence to a lot of people. Now, how about my passes?"

Suvarov produced them out of the lining of his coat. By the light of a small flashlight, he checked the photographs on them, pocketed two and handed two to Michelson.

"The red ones will get us into the building, the gray ones are to be used to depart."

They rode in silence as the truck made its way through the city and into the countryside, finally taking a road leading through the mountain ring toward the secret industrial area. Michelson followed their route with a compass, a series of photomaps he had prepared from his scrambled slides and a pocket-sized battery-operated infrared viewer which made it possible to spot landmarks and read those road signs which were still written in French.

Finally they reached the gate of the compound. There was some conversation between the guards and the truckdriver in a Micronesian dialect. One of the guards beamed his flashlight over the crates stacked on the back of the truck, then waved them inside.

Michelson breathed heavily and murmured:

"That's one hurdle we're over. Now to get out near our building without being spotted. Alexei, if you take out those pins in the end of the crate, the end will swing out on hinges. Loosen all of them and be ready to open the spring latch."

Intently he followed the path of the truck as it threaded its way among the buildings. The truck bounced and swayed so much the compass needle refused to settle

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down. He split his attention between the map and the viewer, trying to correlate the building walls he saw with the roofs on the map. The truck braked to a stop abreast of one of the buildings, then backed up to a loading dock. A gang of men swarmed aboard the truck and clambered over the crates. One of them, equipped with a flashlight, started reading the shipping instructions on each crate. Michelson slid the shutters over the air holes, and leaned back against the side of the crate. He hoped the phony markings Sin Hwang's men had scrawled over the crate would pass muster. There was considerable agitated conversation in Micronesian outside, followed by several thumps on the crate. Suddenly the crate tipped slightly, and Michelson froze. Had the crate inadvertently been consigned to this building? He lurched forward as the crate was shoved vigorously to one side, then felt himself jarred from head to toe as the crate was dropped back on the truck bed. There was a scraping sound as another crate was slid off the truck. Evidently their hideaway had been blocking access to another crate. After some more banging about and moving of smaller crates, the work gang was evidently satisfied that nothing more belonged here, and they trooped off the truck.

As the tailgate banged shut, Michelson let go the air in his lungs and gasped for more. His legs and arms felt like the bones had been replaced by wet spaghetti. Beside him, Suvarov was evidently feeling some strain too.

"Harold, I don't think I'd like to go through that again soon."

"We won't have to. We're getting close. If the truck goes straight through the next intersection, it'll go past our building. I suggest we go past and walk back. If it turns, we better bail out immediately."

As the truck slowed down and began to turn, Suvarov opened the spring latch, and they both hit the end panel in a rush. It swung open and Michelson scrambled after it to keep it from banging against something. As he swung it closed and heard the latch snap shut, he saw Suvarov disappear over the tailgate. Then he was swinging his legs over the tailgate. He hung for a moment halfway over, then heaved up and back with his arms. He hit the ground with legs bent, tucked his head down and rolled.

As he bounced up he heard a hoarse whisper. "Harold?"

"I'm okay, Alexei. Back towards that intersection and turn right." He walked back, brushing the dust off his clothes. He found the Russian whisking his shoes off with a handkerchief.

They walked along the high fence around the building and came to the gate. The guard held their passes under an ultraviolet lamp, then shone a flashlight on their faces while he studied their photographs. Satisfied, he stood aside and let them enter.

They entered the building and passed some offices. Two Micronesians in one of them glanced up, then returned to their paperwork. A

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European in another office did not even look as they passed. Other than these three, the building seemed deserted. They passed through the small office block, and entered the main part of the building.

They stopped and simply stared at the ceiling. I've seen high-bay buildings before, Michelson thought to himself, but this is ridiculous. You could practically stand a football field on end in here. Aloud he said, "Alexei, the processing seems to start at that end on the left. At any rate, the photos show tracks leading to the open hearth mill from that end, and the loading docks are at the other end."

They proceeded to the indicated end of the building. A short length of railroad track protruded through a high door in the end. On the track was sitting a car mounting a steel bottle, lined with fire-brick. The bottle, now cold and empty, was used to carry molten steel from the open hearth furnace. In a pit beside the car there rested a brick-lined ladle. The bottle could be tilted on its trunnions, pouring its steel into the ladle. The ladle was then hoisted by an overhead crane and carried to an array of centrifugal casting molds. Just beyond the molds there lay a set of steel pipes, graduated in diameter. An overhead crane was again used to carry a pipe to what appeared to be a giant lathe, where its entire length was supported on rollers, while the outside was turned down to the proper finish.

"Alexei, if these pipes are to be built up like a cannon barrel, the inner and outer surfaces have to form concentric cylinders. With that lathe, there they can finish the outer surface, but how about the inner surface? Any tool support narrow enough to go into the pipes, and long enough to go from one end to the other, would be too flexible to work with the necessary precision."

"That is one of the ingenious features of this operation, Harold. Where is it now? Oh, yes, over here. See this pit? It's deep enough to hold one of those pipes vertically, with the top just above the mill floor. See that steel shaft in the center of the pit? A cutting tool can be positioned vertically on the shaft, and moved radially from the shaft. One of the pipes is dropped over the shaft, the upper end of the shaft is clamped in that arm which swings over the pit, and those rollers close on the pipe, keeping it centered on the shaft, and allowing it to be rotated past the cutting head."

"But still, the back pressure on the cutting head would bend that shaft several centimeters at the middle. How can they possible meet tolerances in the tens of microns?"

"That is the ingenious part. Once the outer surface is to the prescribed shape, all that is necessary is that the wall thickness be within tolerances at all points, and the inner surface is then automatically the right shape. So they use a radioactive thickness gauge, mounted next to the cutting head, to control the pressure on the cutting head and thus the metal removal rate. One or two passes of the cutting head over the entire inner surface and it is within tolerances."

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They continued to follow the course of the manufacturing process. After the pipes were finished inside and out, they were carried to another section, where they were stored until a complete set was ready. The largest was lowered vertically into a pit, where it was heated and expanded. The next smaller size was then driven into it by a hydraulic ram. When it had heated sufficiently, the next layer was driven in until the tube was complete.

"Our practice is to build up barrels from the inside out. Evidently they have reversed the process here."

"My agent said that Krupp's standard practice is inside-out also, but here that would have meant handling a very hot fifty-meter pipe. They decided it was simpler to build up from outside in, then apply a final strain-relieving heat treatment after the tube had cooled and all layers shrunk tight."

The assembled tube was moved to another pit, where another machining operation brought the inner surface to a mirror finish. Then the tube was moved to another lathe-like machine, and threads were cut on one end. The finished tube was then laid on two waiting truck trailers, which would be pulled outside by a small tug.

Michelson observed that the outside of the tube was covered with eyes, a detail which had earlier escaped his attention. That made sense, he thought. This tube is too long and thin to be rigid. That's what the trusswork and cables in those tunnels are for. They provide these things with an exoskeleton.

He hoisted himself up onto the truckbed and started looking over the tube from various angles. For lack of anything better to do, he pulled out a tape measure and stretched it across the open end of the tube. Outside diameter: one hundred sixty-five centimeters. Wall thickness: thirty centimeters. Inside diameter: seventy-five centimeters.

That sounded familiar. What had he come across recently with a diameter of seventy-five centimeters? Of course! That collar on the satellite! And that collar, in the middle of the satellite, made sense only if the aerodynamic shroud covering the satellite were ogive-shaped both front and rear.

He suddenly had the sickening feeling that he knew precisely what Premier Akandro wanted these things for.

Michelson turned to Suvarov as casually as he could manage. "Alexei, we've been here almost three hours already. We'd better not push our luck. Is there anything more you want to look at?"

"No, I am finished, Harold. We had best leave. I suggest we leave separately. Perhaps I should go first."

"I've been thinking about our departure. I think we'll go out together. And I think you'll walk just a few feet in front of me. And I think I'll have my fountain pen pointed at you during the whole process. And if my exit pass doesn't satisfy the gate guard, you won't live long enough to enjoy having trapped me."

Suvarov looked at Michelson, then at the doorway, then back at Michelson. "I see," he said slowly. "Then

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perhaps you should use this other exist pass I had prepared for you, instead of the one you already have." And he reached inside his coat.

"No, you don't, Alexi. Take off that coat and tell me where the pass is hidden. I'll get it myself."

He went to where the coat was heaped on the floor, and withdrew a pass from the lining. He compared it with the one he already had. It was similar, but there were subtle differences in the lettering, although the photographs appeared identical. Also, other differences might show up under ultraviolet light. It would be just like Suvarov to give him a pass that fluoresced in bright letters, I AM A SPY. "Let's go, Alexi."

They hastened back toward the gate. Suvarov moved a few paces in front and Michelson brought up the rear, fountain pen in his right hand, infrared viewer in the left.

Twice they had to duck into some shadows as uniformed guards walked past. Finally they reached the gate. The guard took his time getting around to them, he took his time examining the passes, and then languidly handed them back.

"It is late. The last bus has already left for Jingjok. Have you made arrangements for transportation?"

Michelson managed to croak through his dry throat. "We have transportation waiting outside."

"Very well." And the guard gave them a bored wave through the gate.

As soon as they were beyond earshot of the guard, Michelson spoke. "I hope you do have transportation, Alexei. It's a long walk back."

"You really intend to let me go back, then?"

"I think that question illustrates the major difference between our sides, Alexei. You didn't try to dispose of me inside the compound, because an unexplained corpse inside the gates would cause the Micronesians to ask some embarrassing questions. But for that practical detail, you'd have murdered me as casually as you'd do it now if our roles were reversed. And you're expecting me to behave just as you would. But we don't happen to go in for casual murder, Alexei. In fact, my biggest problem right now is how to part company with you without giving you a chance to shoot at me, or get a look at who my contacts are. I suggest that you remove all your clothes and give them to me. That should include your identity papers, weapons and so on. I'll drop them in the road up ahead where I meet my contacts."

"How do I know I can trust you to leave them?"

"Use your head, Alexei. I'd no more leave you here to attract attention by your nakedness than you'd leave an unexplained corpse. Besides, I don't care whether you trust me or not. I'm holding the gun."

As Michelson bounced around in the cab of the old truck jolting its way back to town, he consoled himself with the thought that this was a better ride than he had had on the way out. He hoped Suvarov's ride was less comfortable, but undoubtedly he was riding in a chauffered limousine from the Soviet Embassy. Michelson reflected that Suvarov's

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move upon returning to his hotel would probably be to get his suit cleaned. As they swung onto Freedom Avenue, leading toward the Independence Hotel, Michelson noticed considerable hubbub ahead. Cars, trucks and people seemed to be building up to a monumental traffic jam.

"Driver, stop. We don't want to get caught in that." He pulled out the infrared viewer. While there was plenty of light from street lights, making viewing in the infrared unnecessary, the telephoto lens on the viewer still came in handy.

There appeared to be smoke hanging around the hotel, though it was impossible to tell the source. There was a stream of water playing against the front of the building, evidently from a fire hose. The thought struck him. Do you suppose Suvarov tipped off the Secret Police about me, just in case I got out of the industrial compound without being caught? If they raided my room, and tried to open my bags without doing it right, the resulting blaze would at the very least burn out the whole room, and might spread to several others before they got it under control.

"Driver, try to turn around without attracting any attention. Please take me to the Liberation Monument and leave me there." No point in letting the driver know any more than necessary, since Sin Hwang may have sent orders to pick me up through an intermediary. He alighted at the Liberation Monument and walked around it slowly, while the truck pulled away. Then he started for the back-alley route Sin Hwang had informed him about.

VIII

"That's essentially all of it, Chief. Sin Hwang got me on a fishing boat which made a rendezvous with a Kuomintang submarine. That took me to Taiwan, where I caught a commercial flight back home. I had no access to cryptographic equipment either on the sub or at Taiwan, so I could do no more than send a message in the clear letting you know I was coming."

"Looks like Suvarov came pretty close to getting rid of you this time. Why didn't you put the finger on him, too?"

"I thought of it, but at first I didn't know whether he was working with the Micronesians or not. If he were, any message about his being a spy would have started them looking for the sender. After I was sure he knew I was there, it wasn't safe to turn him in. I had planned to send an anonymous telegram from the airport on my way out of the country."

"He was seen in New Dehli shortly after we heard from you via Taiwan, so I presume he left the country openly. Well, we'll have other chances to get him. Maybe we ought to let the Red Chinese know he was snooping on their doorstep. Then they'll be after him too. Now, were you able to come to any conclusion as to the use of those tubes?"

"I think so. Have you ever heard of something called Project HARP? The initials stood for High Altitude Research Project."

"Can't say that I have. What was it?"

"It started over ten years ago. The

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Army paid for it, and the work was done by a Canadian university. They took an old 16-inch Navy surplus gun, and bored the barrel smooth. Then they mounted the thing down in the Barbados, and pointed it vertically. Instead of firing conventional blunt-based artillery shells out of it, they fired long, thin, dart-shaped shells, tapered to a point on both ends. Since the gun was smooth-bored, they had fins on the shell to stabilize it in flight. And to keep it in flight. And to keep it properly oriented in the barrel, it rested on a pusher-plate, and was surrounded by a sabot, which fell off as soon as it left the muzzle. The smooth bore gave the shell a much higher muzzle velocity than a conventional shell, and that, combined with the low-drag shape, allowed them to reach much higher altitudes than would be possible with conventional artillery. The thing was intended to replace sounding rockets, and round for round was considerably cheaper than rockets. There was some talk of building a bigger one which could fire a projectile carrying a rocket. The projectile would be fired to orbital altitude, then pitched over and injected by the rocket thrust. Figured on the basis of dollars per pound in orbit, it figured to be much cheaper than a rocket."

"It sounds like a cute scheme. What ever happened to it?"

"Well, the gun wasn't mobile, so this restricted a high-altitude sounding program to one site. It turned out that people were willing to pay a little more for the ability to launch probes anywhere they wanted. As for a satellite launcher, no one wanted to have to build satellite instrumentation which could withstand the 50,000-g acceleration in the gun barrel. So the thing was eventually dropped."

"And you think the Micronesians have picked it up?"

"Everything fits, Chief. The extra-long smooth-bore cannon, threaded to fit some sort of breech assembly. The exoskeleton, to eliminate sag in the long, non-rigid barrel. The flat-cars, to haul the thing in and out of a blast-proof shelter. The fact that the satellite was apparently designed to fit inside the barrel. And the apparent complete lack of any other means to launch satellites or deliver the nuclear weapons they say they have. Have you got a better explanation?"

"No, Harold. I have to admit your theory certainly fits all the available facts, and you do have the advantage of having been on the spot. I have to give Akandro a lot of credit for the way he's managed things, too. His first announcement about having nuclear weapons lowered his stock a little in the neutralist world. Opposition to nuclear weapons is practically a tenet of faith with the neutralists. And the major powers didn't pay him much attention because they didn't credit him with a delivery system. But when he puts a satellite in orbit, he kills two birds with one stone. The scientific satellite gives him increased prestige with the neutralists. And it's going to occur to the major powers that if he can put a thousand pounds or so into orbit, he can drop fifty-kiloton shells on

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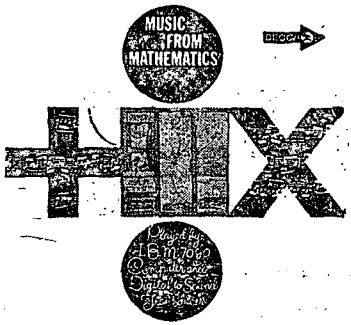

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any place on earth, and do it with enough accuracy to make it worth while."

"It looks like we're going to have to treat Akandro with a lot more respect than we're used to."

"Harold, you're not thinking big enough. Akandro's just the first one. Within five years every two-bit so-called nation in the world that can manage to build a foundry is going to have its own Intercontinental Cannon. And for those that can't manage their own foundry, there will be guns for sale. After all, Akandro's got to keep that factory going, if for no other reason than to retain the capability to make and repair his own weapons. It's possible that even reputable outfits like Krupp and Bofors might get into the business."

"But what can we do?" Michelson asked cautiously.

"To prevent it from happening? Nothing. We're just going to have to get used to a world in which every bearded, Yankee-hating revolutionary, every anti-imperialist leader of a so-called emerging country, can blow up one of our cities any time he feels like it."

"Yeah. And in retaliation, we can bomb his jungles and mountains. If, that is, we can ever manage to figure out which one of them it was that shot at us."

"Well, there's one nice part of our job, Harold. When we get a knotty problem like this, we turn it over to our Constitutional superiors. Come on, let's go spoil the President's day!" END

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ALIEN ARITHMETIC

by ROBERT M. W. DIXON

We count by tens — probably because we have ten fingers. Now how might amoebas count?

Hans Freudenthal, a Dutch mathematics professor, has worked out an elaborate "language" for communicating with extraterrestrials that he calls LINCOS*.

Freudenthal would begin by transmitting strings of numbers (in binary coding), then simple arithmetical additions, subtractions, divisions, inequalities and so on. Then elementary logical relations. And on to ideas of space and time, and more complex behavioral concepts. In LINCOS new concepts are introduced one at a time, each being explained in terms of the concepts that have gone before.

LINCOS is to be transmitted by short-wave radio. Since any aliens that pick up the transmissions must have mastered short-wave radio Freudenthal argues that they would have a mathematics very similar to ours. So that the most obvious and fruitful things to begin transmitting are strings of numbers, and simple arithmetical operations.

But must any alien race (even one that has a physics similar to Earth physics) necessarily use a system of arithmetic that closely resembles our arithmetic?

We cannot answer this question definitely, one way or the other. But there are a variety of different kinds of arithmetic, most of which have just never been used on Earth but could easily be the accepted system on some alien planet.

To find a system of counting, sig-

* Hans Freudenthal, Lincos — Design of a Language for Cosmic Intercourse, Part 1, North-Holland Publishing Company, Amsterdam, 1960.

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nificantly different from the one taught in schools today, we only have to look as far as Roman arithmetic. It is well known that for a Roman to have added up a list of figures using pencil and paper (or wax tablet and stylus) would have been far more difficult than it is for us — which is why abacuses were so widely used in ancient Rome.

Roman numbers can be added, but not by just listing them one under another and adding the columns, like

XXVII
XIX
XLIV
LXI
XLIX

If you don't believe me, try it!

Rather we have to consider the basic symbols Romans worked with — V, I, C, X and so on (like our basic symbols 7, 1, 2, 5, 0 and so on) and arrange these in an ORDERED SEQUENCE, from largest number to smallest:

M (1000), D (500), C (100), L (50), X (10, V (5), I (1).

Now take any Roman number, say MDMCCXLIX.

In this (or any other) number a symbol that is only followed in the number by symbols that come after it in the ordered sequence is counted as positive. A symbol that is followed in the number by symbols that come before it in the ordered sequence (that is, symbols of larger numbers) is counted as negative. This RULE tells us that MDMCCXLIX is plus 2000 (since the M's are only followed by D, C, X and I symbols — which all come after M in the ordered sequence), minus 500 (negative here since D is followed by M, a symbol that comes before it in the ordered sequence), plus 200, minus 10 (since an L follows the first X), plus 50, minus 1, plus 10. So that MDMCCXLIX stands for +2000 – 500 + 200 – 10 + 50 – 1 + 10, that is 1749.

Now in order to add Roman numbers we must write them in a special way, using two columns (one positive and one negative) for each of the symbols I, X, C and M, and just one positive column for V, L and D. Let's try to add up 27, 19, 44, 61 and 49—sorry, I mean XXVII, XIX, XLIV, LXI and XLIX. We use the RULE above to tell us whether each symbol in each number is positive or negative in that number — the RULE tells us that the I in XIX is negative since an X follows it, whereas the I in XXI is positive.

We can now write out the five numbers as:

+L	+X	–X	+V	+I	–I
	XX		V	II	
	XX				I
L		X	V		I
L	X			I	
L	X	X			I

Next thing is to add the columns, taking the total of every negative column off the total of the corresponding positive column. So that three plus Is plus three minus Is make nothing. Two Vs make one X — carry into next column. Six plus Xs, one plus X carried over and two minus Xs make altogether five Xs,

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which is one L — carry over. Three Ls plus one carried make four Ls, which is two Cs. So the total is CC, or, to us, 200.

(Notice that we need only one column each for V, L and D since these never occur negatively in a number — it's not difficult to work out why this is so.)

Counting the Roman way has one big advantage over the Arabic method of counting that we follow nowadays. The Romans only needed four symbols (I, V, X and L) to count up to 88; with five (adding C) they could reach 388, and six took them right up to 888.

We need ten symbols (1, 2, 3, 4, 5, 6, 7, 8, 9 and 0) just to count as far as ten!

But our ten symbols then take us as far as we want! Any finite number can be expressed in terms of some or all of our basic ten symbols.

A fundamental difference between Roman numbering and Arabic numbering can now be seen. The Arabic system uses all its basic symbols very early on — after number 10 no more new symbols will be introduced. Roman numbering introduces its symbols gradually — the first at 1, next at 4, then at 9, then 39 and so on. It seems likely that the Romans would have carried on inventing new symbols for larger and larger numbers, if they had had cause to deal with extremely large quantities.

However, both our way of counting and the Roman way have one big factor in common: they are both decimal systems. That is, they operate with multiples of 10 — they have a "base" of 10. In fact any number could be the base of a counting system. Numerical data fed into electronic computers is always in binary form — to base two — for instance. A binary system only needs two symbols — usually 0 and 1 are used. Then binary 1 denotes decimal 1, binary 10 decimal 2, binary 11 decimal 3, binary 100 decimal 4, and so on. Binary number 1101001 is (working from right to left) (1x1) + (0x2) + (0x4) + (1x8) + (0x16) + (1x32) + (1x64), that is decimal 105.

Binary numbers tend to be longer than their decimal equivalents, and would be much more difficult for human minds to remember and work with. (Computers don't have the same sort of limitations.) But the choice of ten as base for modern numbering systems is mostly a historical accident. 10 factorizes rather clumsily as 5x2. 12, factoring more neatly as 3x2x2, would really be a more suitable choice than 10.

Whether we count in twos or in tens (or even in thirteens or nines), terrestrial arithmetics all take one big axiom for granted. This is, that a number system should have a fixed base.

Alien cultures could well have evolved rather more subtle arithmetics that do not follow this axiom.

For instance, a quite workable number system could be in terms of a gradually increasing base. Single-digit numbers might be to base two. Two-digit numbers could have the "tens" digit to base three and the "units" digit to base two. In three-digit numbers the "hundreds" digit

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would be to base four, the "tens" digit to base three, and the "units" digit to base two. And so on.

So that we would count:

Increasing base system	Decimal system
1	1
10	2
11	3
20	4
21	5
100	6
..	.
..	.
..	.
321	23
1000	24
1001	25
1010	26
1011	27
1020	28

and so on.

The rule for forming numbers in this system is that the highest number that can occur as rightmost digit is 1, the highest number as second digit to the right is 2, . . ., as fifth digit to the right is 5, . . . etc. Generally, where N denotes any chosen number: the highest number that can occur as N-th digit from the right is N.

So that, for example, 5021 does not denote a number of this system since it breaks the rule (just as, for example, VXI does not denote any Roman number, but is just nonsense). But 4021 is a number of the system (equal to (1x1) + (2x1x2) + (0x1x2x3) + (4x1x2x3x4) = 99).

The increasing base system introduces its symbols gradually. Symbol "6" isn't needed until we count as far as 720, and "9" not until we need to talk about 362,880 or a higher number. But the number of symbols required isn't finite (as in a conventional decimal or binary system) but potentially infinite. This is a theoretical point which isn't likely to worry the everyday users of such a system too much, though — after all, the first five billion numbers can be counted using thirteen symbols.

We count to ten probably because we happen to have ten fingers and ten toes. It's not hard to imagine some similar cultural-feature leading an alien race to develop an increasing base system.

Consider a race with two basic sexes. At breeding time each member of the female sex comes together with a variable number of males. In its first year of breeding a young female has one breeding pod, and that year a single male will attach itself to this pod. As a result of the breeding an egg will be laid (which may or may not be fertile) and also a second breeding pod will grow. The second year two males will breed with the female — one to each pod. Two eggs will be laid and a third pod will grow, for use in breeding the third year. Each year a female has one more pod and breeds with one more male than the year before. And each year it lays one more egg than the year before.

Now if this race ever developed a number system it could well be an increasing base system: with the first (rightmost) digit being 0, or 1, the

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next, 0, 1 or 2, and so on — on the physical analogy of a female laying one egg (which might or might not be fertile) the first year of breeding, two the next (so that 0, 1 or 2 eggs could be fertile), three the next (0, 1, 2 or 3 could be fertile), and so on.

We can notice, by the way, that an increasing base system of this sort lends itself just as easily to addition as a fixed base system. All we have to remember is the basic rule of the system — that we can't have any number larger than three as third digit from the right in a number, any number greater than four as four digit from the right, and so on.

Thus adding 53021 (decimal 677), 14300 (decimal 234), 3320 (decimal 94) and 21011 (decimal 267) we get:

```
 53021
 14300
  3320
 21011
 -----
 14300
```

Adding the rightmost column gives 2, and so we carry 1 into the next column and note down 0. The second column adds to 6 — carry 2 and enter 0. Third column gives 8 — carry 2 and enter 0. Fourth column adds to 13 — carry 2 and enter 3. Last column gives 10 — carry 1 and enter 4. And the total is 143000 in increasing base arithmetic, which is decimal 1272 — (0x1) + (0x1x2) + (0x1x2x3) + (3x1x2x3x4) + (4x1x2x3x4x5) + (1x1x2x3x4x5x6) = 1272.

Finally, let's look at an imaginary alien race whose physiology is fairly rudimentary, and see whether they are likely to develop a correspondingly simple arithmetic.

A race of amoeba-like creatures, for instance, who "breed" by the simple process of one creature dividing itself into a number of pieces — each piece then being a fully fledged member of the race on its own account. Let's say that they are not restricted to binary fission, but that each creature can divide itself into any number of pieces.

One of these creatures may split up into five pieces, and each of these pieces into three more pieces. There are now fifteen creatures corresponding to one original creature, and these fifteen have been created by a five-way split and then five three-way splits.

When this race comes to develop a system of counting, it seems rather likely that they will want to be able to see, at a glance, the factors of any number. In this way their arithmetic will be immediately functional for the important task of calculating the products of successive fission.

They might in fact well develop a prime-number system of counting something like this. A simple symbol is assigned to each prime number, for instance:

1	ʎ
2	–
3	|
5	o
7	□
11	∩
13	⊓
17	∪
19	⊔

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And then each non-prime number is given a complex symbol made up of the symbols of its prime factors. For example, the symbol for 6 is made up of the symbols for 2 and 3; the symbol for 60, of a 5 symbol, a 3 symbol and two 2 symbols. (See figure on page 119.)

Counting in this system might be verbalized something like this: One; two; three; two-twos; five; two-times-three; seven; three-twos; two-threes; two-times-five; eleven; etc.

Aliens who learned this sort of arithmetic wouldn't need to learn multiplication tables, since to multiply two numbers you just combine their symbols.

For us earth-type creatures, addition in a decimal arithmetic is fairly easy. We merely have to follow a few rules about starting from the right and carrying over to the left. Multiplication is a little harder — there are more rules to learn and master. We could say that our number system was mainly devised with addition in view: so that addition and subtraction are more straightforward than multiplication and division.

In the amoeba-type system multiplication (and division) are easier than either decimal addition or decimal multiplication.

But simple addition in the amoeba system would be extremely complicated. In fact, there would be a number of different kinds of addition:

(1) addition of two identical numbers — just add the symbol for 2 into the symbol of the number.

(2) addition of numbers with some factors in common (i.e. some part of their number symbol in common). First take out all common factors. Then "add" (using special addition tables perhaps) the rest of the numbers. Finally write in the common factors again.

(3) addition of number with no factors in common — just look up addition tables.

The main disadvantage of this system is that it would need a very large number of symbols — one for every prime number. In practice, though, we could use various conventions to lessen the number of symbols required. For example, a very large prime number might be referred to by the symbol of the number one greater than it, with a dot underneath. (And then of course we'd also need more complex conventions for "adding" symbols together in multiplying large numbers.)

All the number systems mentioned above have their advantages; and each also has certain disadvantages. The sort of criteria that are likely to be relevant in choosing a number system will include some of the following:

(1) that the string of digits representing a number should be as short as possible. On this count a decimal system would be preferred to a binary system.

(2) That the total number of symbols used should be as small as possible — this criterion prefers a binary system to any other.

(3) That counting up to 100, say, should not require too many symbols. Here the Roman system and

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the increasing base system score heavily, and the Arabic decimal method rates less well.

(4) That addition and subtraction should be quite straightforward. Arabic decimal and increasing base systems satisfy this criterion much better than the Roman system or the amoeba-type prime number system.

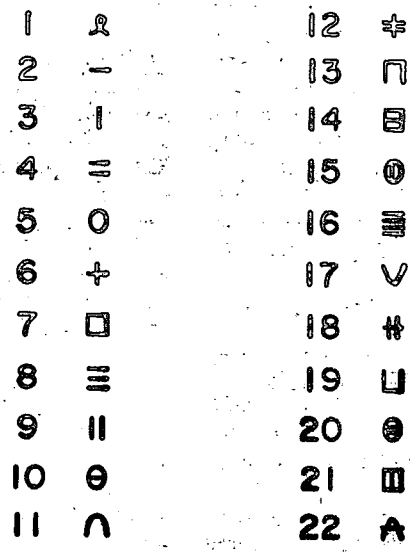
(5) That multiplication and division should be quite straightforward. Here the prime number system easily beats a decimal system.

Different cultures are likely to have different applications in mind for their arithmetics. Robots with computer brains might stress criterion (2) above all others, and develop a binary system. Amoeba-like creatures, as discussed above, could stress criterion (5) and move towards a prime number system.

Humans tend to place more emphasis on criteria (1) and (4) — so that a decimal system is more suitable than a binary system or a prime number arithmetic for our needs.

In fact it's fairly certain we would find a system to fixed base 12 (a duodecimal system) a little more workable and economical than a system to base 10. Probably the only thing that has turned us towards decimal arithmetic has been the difficulty of counting on one's fingers in a base 12 system if one has only ten fingers.

But physical limitation and analogy will always play a relatively minor role in the development of an arithmetic. The basic type of arithmetic that is evolved within a particular culture will mostly be determined by the nature of that culture, and the specific tasks the arithmetic will have to perform. END



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Trees Like Torches

by C. C. MacAPP

Illustrated by GAUGHAN

The forest lived, and it was the enemy of their enemies. But it was not their friend!

I

Murno, on his belly under some bushes on the eastern slope of a mountain, accepted the telescope from the man beside him, laid it across his left wrist to steady it, and focused on the small clump of trees far out on the flat. Early afternoon shadows made it hard to see the pair of men sitting there, but he finally handed the scope back and said, "Two's all I make out. No sign of the children."

Pete nodded. He was a scout of the Sierra Norms with whom Murno and his family had found sanctuary this past year. "Just rear look outs.

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The main band'll be several hours ahead. We gave them a lesson the last time they tried this."

Murno, whose ten-year-old daughter was one of the kidnapped youngsters, felt annoyed at Pete's casualness. He said nothing and studied the flat. The country just east of the Sierras was certainly different from the western slopes—much drier; its short grass brown now, brush or scattered oaks only along the few dry washes. There was one creek with a little water in it, a few miles south. In the low spots of the flat without drainage, alkali stopped all growth except a certain sparse grass.

He said to Pete, "You call it two nights' trek across the flat. What's beyond?"

"Hills, high enough to catch a little rain, fairly well wooded. Beyond those, there's supposed to be ten thousand square miles of basin that water drains into from all sides, covered with what's called the Black Grove. The renegades we caught last year said that was where they intended to trade the children."

"To whom?" Murno asked, "And for what?"

Pete shrugged. "The ones we caught didn't know."

Murno supressed irritation. "Who are these renegades, anyway? Are they Norms? Where do they come from?"

"Norms; what else?" Pete shifted position. "They hole up somewhere south of the Black Grove. There must be quite a colony of them. They raid free farmers and anyone else they can." He scowled. "I'm not keen on taking the field with Bluies, even if they *are* supposed to be our allies now."

Murno didn't answer at once. From habit, his eyes scanned the sky for Gaddyl aircars, or the aliens' mutated hunting-birds, called gee-hawks, even though he wore strapped to his left forearm an instrument of the Sierra Norms that would locate radio sources too far away to be seen. Finally he said, "When you get into strange country you may appreciate the Bluies and their talents."

The sun was long lost behind the Sierra summit when the rest of the expedition arrived.

The first inkling Murno had was when he began to imagine that a feline—lighter in color and more compact than a tiger, but bigger and bunchier than a puma—was about to pounce on him from behind. He thrust the thought away; he'd chosen this cover carefully. Then he had the feeling that the bramble thicket behind him was much thinner than he'd thought, and the cat had found a way through it. The feeling was so strong that he turned his head to reassure himself. The bramble was as thick as it was supposed to be.

He grunted in annoyance and wriggled clear—to where he could see the five young-looking blue men, grinning, their hands still poised in the intricate gestures that could make false thoughts in a man's head or put him to sleep. They were nude except for G-strings, moccasins, and leather belts from which hung darts and throwers and a few small bags. Their skins were hairless and quite smooth, matching the deceptive

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smoothness of their muscles. They were running four cats, which—tails lashing, not happy at being restrained—sat on their haunches a few feet away.

Pete came out from under the bush, saw the cats, cried out in shock and raised his airgun.

Murno knocked it aside. "These are friends." To the blue men he said, "It's good to see my hunting-companions again." They nodded, but said nothing. He noted, with a grin, that their scalps were clean-shaved again. The loss of hair-patches and the vow of silence no doubt meant they'd been caught playing pranks again. He said, with a little malice, "This is Pete. He claims that every one of his ancestors was a Norm, and that none of them were ever conquered by the Gaddyl."

Pete reddened and mumbled, "What's wrong with them? Can't they talk?"

"Not for a while," Murno told him. We went over to make friends with the cats. Two of them already knew him, but he wanted to be sure all four would recognize him by smell if he happened upon them in the dark.

A more mature-looking blue man, with a full though close-cropped head of hair, came down the slope. "Murno! It's been almost a year!" He frowned at the five younger ones. "Have my nephews been pestering you again?"

"No, no," Murno said. "Kal-Let, this is Pete." He waited for the two to exchange nods, then asked, "How is the Old One?"

"He is well," the blue man said. "He sends you greetings and bad news. Many of your former neighbors have been caught. The fief Guddun has killed some and re-enslaved others. Also, he has alerted the other fiefdoms that there are hostile Norms in the mountains, and he appeals to the Planetary Prime for more weapons and aircars."

Munro listened soberly. The only reason Earth had been allowed to return to wilderness and partial freedom was that, for the Gaddyl, it was an out-of-the-way planet, only occupied by fifty or sixty isolated Gaddyl fiefdoms, and not exploited much. Guddun, however, who had just inherited a fiefdom, had a grudge against free humans. Murno asked, "What of your own people?"

Kal-Let told him, "Some of us have been killed. And we have killed Gaddyl."

The other Norms arrived in a few minutes. There were twenty of them, men of the summit, like Pete. All were carrying airguns, all wearing the camouflage coveralls of woven fabric, green splotched with brown and gray, heavy ankle-length shoes, brimmed hats covered with netting into which foliage or straw could be stuck. The young Blues took time from soothing the cats to grin at the clothing. Murno, whose lighter leather garments were more practical, made a mental wager that the Norms would be shedding before they'd gone far.

It was dark enough now to start. Murno of course could not match the Blues as a stalker, but he was the only leader acceptable to both

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groups. He pointed out a dry wash he'd chosen earlier. "We'll go down that until we get a track."

The cats, playful with the coming of dusk, sported about investigating this and that, but there was usually at least one out ahead. Pete's men traveled single file, their shoes making more noise than Murno liked, so that he moved on ahead with two of the younger Blues. Kal-Let and the others were at the rear, in case something hunted the hunters.

Nothing much happened in the first two hours. Once the cats flushed something bigger than themselves—a lion, maybe, or some Gaddyl-mutated beast—and there was a contest of snarls, but the thing fled. Another time, the instruments picked up an aircar going over. But it was high, and if it had geehawks they weren't flying.

Not long after that the cats began sniffing around the clump of trees where the renegade rear-scouts had been. Kal-Let came up, listened to the cats' scratching about, and said, "they must have left before sundown. Is it your wish to catch them?"

"Not yet," Murno told him. "That would warn the main group. If we can just get past them and gain as much time as possible on the others."

Pete was nervous out here in open country. He put in, "The kids won't be able to travel very fast."

Murno didn't argue that point, though he thought if the youngsters had nothing to carry they could keep up with adult Norms. He asked Pete, "Is there anything they'd have to detour around?"

"Not that we know of."

Kal-Let said, "In that case, they are going just a little south of east. If you wish, Murno, I can scout ahead with the cats and locate the two."

"No, I think not. Let's angle off southward, so tomorrow we can use the telescope with the sun at our backs."

II

With the first light of morning they found the best cover they could—a group of five fair-sized oaks. After scouting it they chose lookout posts in the trees. Murno, Kal and Pete went aloft while the others made themselves as inconspicuous as possible on the ground. The sun began its climb. The Sierra men began shedding garments.

Murno eased his weight around carefully, so as not to shake the foliage, and chewed dry cooked venison highly seasoned with salt and onions. It was going to be a long day.

In such open country they could only travel at night—not only because the renegades might spot them, but because geehawks probably would. There were a few of the big birds aloft already, to the north, soaring high up in wide circles that gradually moved this way. There was a fiefdom somewhere north a hundred miles or so, but these birds wouldn't range that far; they must belong to some hunting party. Murno was in the position of hoping the renegades would be careful.

It was mid-morning before he saw the two renegade rear scouts again.

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He wouldn't have seen them at all if one hadn't got up to stretch just when Murno was looking. They were under a pair of trees more than a mile away. Silently, he pointed, and Pete squirmed into position to use the telescope. "Same two."

Kal, in an adjacent tree, said, "There are others north and east of those, I think."

"Where?" Pete demanded.

"I do not know," the blue man said, "but those two look in that direction, and once they signaled."

Pete grunted. Murno waited nervously, but Kal didn't take offense.

After that, Murno spent most of the day watching the two renegades or scanning the sky for hawks. The blue men appeared to nap much of the time. The cats were off somewhere, probably in a dry wash where they'd gone at sunup. They'd have sense enough to stay out of sight and not wander beyond call. It was the Sierra men who were miserable. Stripped to their underwear, they tried sleeping, talking, gambling, eating, working at their guns, without easing their boredom. Around midday one of them demanded of Pete, "Damn it, why can't we go off south somewhere and hunt fresh meat? No one's going to see us."

"What would you hunt?" Pete asked him. "We haven't seen anything bigger than a rabbit all day."

One of the young Blues said, "there is a herd of bovines only a few miles away, beyond that slight rise. Have you not smelled them?"

Pete scowled. "All I smell is—"

Murno interrupted hastily, "Keep your voice down! There's also an aircar somewhere south, maybe after those same bovines." He hadn't seen the car, but he'd watched the hawks move south, then converge and drop from sight.

An hour later his guess was confirmed. There were rifle shots—the chemical-explosive kind the Gaddyl used for sport—from beyond the rise. He told the men, "Get in close to the treetrunks, and bring your clothes with you." He peered southward. This side of the rise, he saw one of the cats creep up out of the dry wash and lie on its belly, head on the ground, listening. Kal saw it also, and said something to the young Blues. From the ground they couldn't see the animal, but one of them sang a soft high note and the cat's ears twitched. A moment later it retreated to the dry wash.

Murno never did see the aircar; maybe it was staying within a few feet of the ground. But late in the day the hawks went north, in a group and not very high, which meant they'd been released from hunting and were going somewhere to be fed. The aircar might or might not have moved off in another direction. Sometimes, if there were a lake or river, the nearly-amphibious Gaddyl sportsmen stayed out overnight.

He turned his attention back to the renegade scouts. Before the sun dropped behind the mountains, they left their post and trotted eastward. No doubt they'd speculated as he had about the Gaddyl party, and were risking an early start rather than staying here. He resisted the urge to follow.

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That night he pushed his own party hard, only stopping twice to rest briefly, swig from waterbags and chew dried meat.

It was still dark when they reached the wooded hills.

These were pines, of a sort that had branched trunks and didn't grow very tall; good cover unless something happened to pass directly overhead. One of Pete's men immediately demanded, "What about fresh meat?"

Murno hesitated. After all, these Sierra men had been dodging the Gaddyl for generations. "All right. A couple of you can hunt. But don't go more than a mile from camp."

He himself took two of the younger Blues and headed up a hill to the north. From the top, he could see back over the way they'd come during the night. There was a small dust cloud on the horizon—the bovine herd, possibly, running from Gaddyl huntsmen, or a band of wild horses. Closer, a few solitary animals were grazing. His instrument showed no aircars or radio-carrying geehawks within range. A few miles south there was a stream, as he'd suspected, following west from these hills.

He inclined his head to the blue men and started over the crest of the hill. Suddenly he stopped.

The valley to the east was deeper and greener than he'd expected. He asked quietly. "Is there water?"

Now, under necessity, the young mutants could break silence. One—Murno thought it was the one called Liss—said, "There is water. I hear no ripples, except from the north, so I think it is a lake."

Murno considered. There might be game, and the Gaddyl might come here. He could retreat swiftly, or try to have a look first.

He wet a forefinger in his mouth and held it aloft. What breeze there was wouldn't carry their scent down the slope. He unslung his bow and held it, with two arrows, in his left hand, then stepped warily down the slope.

There was a lake; narrow, fed by a stream from the north. The outlet was undoubtedly the stream that turned west onto the flat, so the lake was quite long. He stood still for a minute, listening for sounds that the Blues, never having had much contact with the Gaddyl, might not recognize.

It was lucky he did; for though he heard nothing, he saw something that made his stomach knot.

Slipping among the trees on the opposite slope, silently, was a band of breloons—the Gaddyl's fierce, oversize, keen-scented mutant baboons. That they ran silently indicated a fresh track—not a man's, or they'd have been in full clamorous cry. But they were headed upstream and were likely to cross a fresh trail of the renegade rear guard.

What to do? Run back to camp, get the others to the stream and intercept the beasts? Too little time. Anyway, at least some of the breloons would have radio-collars, and Gaddyl monitors would be listening. Divert them? That was just as bad.

The cats! He stared up the valley, where he could still see an occasion-

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al flash of brown. There'd been at least a dozen breloons; too many for the cats. But maybe dart-wounds would look like claw or tooth-marks, when the Gaddyl got there. There'd still be a hunt, but maybe the cats could evade it. He whirled to Liss. "Can you mind-talk to your brothers from here? And to Kal?"

Liss looked doubtful. "Feelings — danger — maybe. What is your idea, Pale One?"

"Kal will know what to do! Try to send a . . . a conception of the creek, and breloons moving up the far bank. And the cats fighting them!"

Liss and his brother frowned in concentration; began moving their hands, faster and faster. Liss sang, very softly, a tuneless little song to himself. His face twisted, as if he watched some swift drama. Murno's own head filled with shadowy pictures . . . Breloons loping silently . . . A stream, burbling down a valley with the sun rising beyond it . . . *East,* East, beyond the ridge . . . The cats charging! A tangled fight! Murno clamped his lips on a cry; pressed hands to his temples —

Then the pictures were gone. Liss said proudly, "It is done! I did not think that — no one of our generation has handled such a complex thing!"

Murno turned and hustled diagonally up the slope, toward camp. Before he was halfway he heard a sudden bedlam up the valley. The roars and shrieks lasted only seconds, then there was only the terrified chatter of the breloons, fleeing back downstream. He'd never known breloons to act like that. His two companions were grinning, trotting easily beside him while he pounded along, struggling for breath.

They reached camp and found Pete's men crouched with their air-guns ready. Pete called to Murno, "What happened? The Bluies suddenly took off with the cats as if all the Gaddyl in the world were after them! Then that racket —"

Liss told Murno, "My brothers and my uncle put thoughts in the minds of the breloons. The beasts saw a whole mountainside full of cats charging at them, each ten feet tall. They will not come this way again."

Pete started to say something and Murno cut him off. "Quick! Over the ridge!" He himself started off at a run. They topped the ridge and met the other Blue returning. He waved them back toward the stream, beyond which could be seen at least two dead breloons. "Upstream, in the water! We can't leave a trail!"

The Sierra men cursed at getting their shoes soaked, but everyone obeyed. Murno didn't dare take them more than a mile. At the first break in the hills on their right, he led them out of the valley and eastward.

There was danger, now, of being spotted by renegade scouts, but the vital thing was to get far from the dead breloons. Things weren't as bad as they might be, of course. Fresh packs of breloons would only pick up the track leading out onto the flat, and the one he and the two young Blues had made, looping to the lake and back. And by the time

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those were chased down and puzzled over and rejected he'd have some distance.

III

Pete walked in surly silence for a while, then fell in beside Murno. "These damned Bluies. I never believed all the stories that they could read minds and hypnotize people and all that. Tell me straight. *Can* they do things like that? What are they, anyway? Aliens, like the Gaddyl?"

Murno sighed. He'd told the Sierra leaders all he knew about the mutants, but they hadn't seen fit to spread it. "A thousand years or more ago, the Gaddyl were still experimenting with human mutations. They produced a few specimens with blue skins and very keen senses. For what purpose no one knows. But the specimens turned out to have talents the Gaddyl didn't expect, so they were killed. But two males escaped and were never caught. One survived and hid somewhere on the western slopes of the Sierras until the search was abandoned. Apparently the Gaddyl didn't know that, besides the other things, he had a very long life span. Eventually he mated with Norm women — maybe from your own ancestors — and all the Blues are descended from that. So they're all half Norm. The original escapee was killed in a hunting accident when he was six hundred years old, but I've met a surviving son. They call him the Old One, and he's a loose ruler of all the tribes. He and his sons have a lot of the original talents, including the ability to communicate clearly with each other over long distances; but each generation has less talent and a shorter lifespan, and looks more like Norms. The vow of silence is imposed on children to make them use what talents they've got. If they communicated by speech, they'd never develop it."

Pete clumped along, muttering, for a while; then, "That's what they *told* you, maybe. But how come the Gaddyl have left them alone until just recently?"

Murno said, "Remember that generations of Gaddyl have come and died. Most of the fiefs have been easy-going. The Blues took pains not to bother them or interfere with their hunting. And the Gads couldn't flush them out except by destroying game refuges."

Pete spent a while absorbing that. Finally he growled, "Suppose all that's true. I'm still not going to *like* anybody that can do things to my head whenever he wants to."

Murno didn't exactly like that himself. He said, though, "They've vowed allegiance against the Gaddyl, and they'll keep the vow. If these five young ones act up a little, try to remember they aren't really mature yet."

Pete said, "That's another thing. They claim to be brothers, but they all look the same age."

Murno grinned. He thought he'd better not mention that the youngest was one hundred twenty-eight.

Before mid-day they had to take cover because geehawks were circling overhead.

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At least the Sierra men weren't bored now. They sat with their backs to treetrunks, or lay in underbrush, eyes fixed on their instruments. Murno couldn't help wondering if they realized how feeble their own painfully acquired technology was compared to the Gaddyl's. They hadn't seen much of the latter.

There'd been no indications of breloons on their trail yet, but it wasn't likely the false leads would occupy the search much longer. Murno had chosen the hardest, dryest ground practical, and on a warm day like this the track shouldn't last more than five or six hours. Still, the hawks here proved the Gads were suspicious, and serious. All they knew, probably, was that something very ferocious had routed a band of breloons; but they'd want to know a lot more. What Murno feared most was that the renegades' main group would get too worried and flee, leaving the kidnapped youngsters to occupy the breloons. It was possible their rear guard had heard the fracas. They knew about the lake; they'd taken a route to pass north of it. And they'd surely seen the hawks by now.

Did the Gads know that renegade Norms roved this country? If so, what was their attitude? This was beyond the borders of the west coast fiefdom where Murno had spent his early years — Guddun's fiefdom, now — but unless some other fief claimed this territory, any Gaddyl might come here to hunt.

In mid-afternoon the hawks found something. The ones overhead all soared away northeast, and the instrument Murno carried showed aircars headed that way. The men realized now what that could mean. Several, who had sons or daughters among the kidnapped, conferred excitedly then came to Murno. "We've got to help if we can!"

Murno swept a quick look across the sky. "Keep your voices down. That's probably the rear guard they've spotted, which means that's exactly where we don't want to go." He stood pondering. "Liss, can you keep contact with your brothers, all alone?"

Liss got to his feet in one easy motion. "At least partially, Pale One."

"Come with us, then. Kal, will you take the others and the cats and keep north of us for a screen?"

Kal grunted assent and beckoned to his nephews. The cats, relaxed in the shade, leaped to their feet and followed. Murno started southeast at a trot. Pete caught up with him. "Why this way?"

Murno hid his impatience. Pete wasn't very sharp in the field. "Because if that's the rear guard, the main group's farther east; and I want to keep south of them if I can." He set the hardest pace he could. Occasionally, Liss would pull ahead, stop, and seem to be concentrating. After a few miles he said, "Pale One, my relatives are trying to tell me something. There are hawks, circling again, and the sound of breloons tracking men."

Murno demanded, "Where are Kal and your brothers situated? Can you see?"

"They are on a hillside, well hidden, above a creek — the same one

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we crossed. The valley below them is thickly wooded. The hawks do not have sight of anything, and the breloons are not close to their quarry."

Murno sighed in relief. The main group, with the children, wasn't involved then. The rear guard, knowing the country, had a chance. If they were caught — well, it was a harsh thought, but he hoped the breloons would kill them before they could be interrogated.

He turned and slogged on grimly. The main group would be pushing the children hard.

Within ten more miles, the country changed abruptly. There was open rolling land again. On the horizon was a low dark line that must be the Black Grove; a good four hours' hustle away, he thought. The only cover between here and there was a stream, a couple miles to the north, bordered by large trees that looked like cottonwoods.

That would be where the renegades had gone, of course. He'd been a little cautious and gotten farther south of them than he intended. He peered around, unhappy with the layout. Following that creek down to the Grove would not only risk an ambush by the renegades, but also discovery by the Gaddyl if they picked up the fugitives trail quickly. Yet he couldn't cross in the open, in daylight. And neither could he wait. So it was the creek, and he'd better not delay. At least he had Kal somewhere to the north to warn him of trouble from that direction. He gestured to the men and led north, along the edge of the hills.

Half an hours' hard going brought him to where the creek left the hills. He stared out cautiously from cover, wondering if Kal had had to stay holed up farther west. He turned to Liss and found the blue man grinning. "All right, what's the joke now?"

Liss pointed. Murno looked and saw Kal beckoning to him, half a mile down the creek. With a curse, he called to Pete and led the way to the creek.

It was easy going in the screen of cottonwoods. When they reached Kal-Let, the blue man took in Liss's grin and frowned. "Liss could have told you, Murno, that we were ahead of you. When we saw the breloons were all busy, we came this way fast. I thought it best to scout the creek at once. The ones we hunt passed this way about noon, hurrying. The children were with them. They are tired, judging by the tracks."

Murno was already moving. The sun would be down before they reached the Grove; the renegades might already be there by now. If it were as thick a forest as Pete thought, the chase wouldn't be easy.

A few miles along, Kal and Liss stopped suddenly, raised their heads as if listening, beckoned to Murno, and hurried on. Presently Murno saw them gathered with their relatives and the cats. Two renegades, disarmed and scared, were backed up against a big treetrunk.

Murno hated to spend the time, but he knew it was best to interrogate them. He walked to within a few feet and held out his hand to

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one of the cats, which hurried over and stood beside him hopefully. He told the ruffians. "If you talk fast and truthfully, we may not kill you. Where were you taking the kids?"

One of the men blurted, "To the edge of the Grove, to trade to the Bigears."

Pete arrived in time to demand, "What the devil are the Bigears?"

"Mutants," the man said, eyeing the cat nervously, "That live in the Grove."

Murno asked impatiently, "What do they want with the children?"

"I — I don't know." The man's guilty face implied he'd made some unpleasant guesses.

Murno demanded furiously, "How long will the trading take? Are the Bigears always waiting?"

"I ain't . . . sure," the ruffian pleaded. "I've only been there once before. The way I understand it, we were going to tie the kids to trees and leave, and the Bigears would come and get them after dark. They never come out in the daytime. Can't stand the light."

Murno fought for calmness; started to turn. The man said, "We were only hired as scouts. We didn't have anything to do with —"

Murno turned back to him, murder in his veins. "You live somewhere south of here?"

"That's right. Yeah."

Murno told him, "You'd better go that way, fast. I guess you know there'll be Gads here before long. And if *we* see you again we'll kill you. Now scoot." He was moving as soon as they were, with only a couple of backward looks to make sure they were obeying.

He led the way recklessly, relying on the cats to nose out any ambush in time. There was none. The renegades had evidently only left two men behind as a precaution. The sun seemed to plummet into the west. It went down, and the Grove was still only a black line in the east. Another hour, and he could smell the dankness of it; feel the moister air.

Still, it was two hours after sunset before they reached it. He posted lookouts, then risked torches to learn what he could from the tracks.

The story was plain. The children had been tied to treetrunks with leather thongs, and their captors had gone south along the edge of the Grove, on the run, no doubt desperately worried about Gaddyl. Someone — the footprints were bare, and not much bigger than the childrens' — had come, cut the thongs and herded the youngsters into the Grove.

Murno, sick with exhaustion and despair, stared at the tunnel-like black hole where the creek, and a path to the left of it, went in. The cats were sniffing about, intrigued but wary. Finally he mustered enough decision to say, "I guess we'd better not take torches."

Pete protested, "Are you crazy? You'd walk right into treetrunks in there!"

Kal put in, "Torches would only make us good targets. We and the cats will go first. The rest of you follow by ear."

Pete glared at the blue man. "To hell with that. Wait for morning!"

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One of the other men said harshly to Pete, "You don't have a child in there."

Murno said firmly, "We'll go without torches, at least as far as there's a well-worn path."

IV

It wasn't comfortable. The path was smooth and he could feel his way somewhat, through his mocassins; and the creek rippled enough so he didn't blunder into it. Ahead, he could hear the cats sniffing and mouthing soft complaints. He kept both hands out in front of him so he wouldn't bang into trees. Behind him the Sierra men were having hard going, and swearing about it under their breaths.

An hour, more or less, passed. There should be a moon by now, but the foliage overhead hid it completely. He wasn't surprised. If, as the renegade had said, the Bigears couldn't stand daylight, this must be a pretty dark place even at noon. He pushed himself another hour, then called a halt.

The men grumbled again about the dried meat, and quarreled disheartedly among themselves. Murno thought ten minutes had passed, but he couldn't resist a few more.

Suddenly, a tree beside the path glowed like yellow-hot iron.

There was an uproar. The men were shouting; jumping to their feet and stumbling over each other. One of the cats leaped over Murno's outstretched legs. It landed in a crouch and whirled this way and that, snarling. The blue men were on their feet, knives in their hands. Murno got as far up as all fours, then stayed there, bewildered. It appeared they hadn't been alone.

Five or six small men, not over five feet tall, crouched scant yards off the path, as startled as he was, huge bulging eyes covered by tight-squeezed lids. Their ears were bigger than a man's open hand, and stood out from their heads. Their skin was dark gray. They wore practically nothing and carried some kind of dart-throwers. An instant, and they whirled away and vanished among the trees, jabbering in ludicrously deep voices. Murno caught, in the distorted dialect, the words, "Great One" and "Norm-devils." The latter, he presumed, fit him, as well as the Sierra men. Something huge moved at the edge of his vision. He jerked his head around and saw, back along the trail, a great bear-like shape shuffling into darkness. An owl swooped away in startled curves. Mice, squirrels, other small things he didn't know — all with huge eyes and ears — scurried away from the light, protesting in various ways.

Incredibly soon, everything was gone. Now he had time to realize that the tree was not giving off heat, and that it glowed all over, from the base of the trunk to the highest leaf he could see. Those leaves were round, six inches across, and as thickly packed as they'd have to be to cut out all daylight. Eight or nine feet up the straight trunks branched. There short spines or barbs, with thick stems and enlarged, pointed heads, radiated out as if to repel climbers.

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This tree was not the kind at the edge of the Grove.

The glow persisted a minute longer, then cut off suddenly. Now the dark was a frightful thing. Murno was glad when one of Pete's men struck a match and lit a torch.

Pete said huskily, "Let's get out of here!" and turned. A man stepped in his path, jaw set. "No. My boy's in here somewhere. But it looks now as if we're better off with torches."

Kal said calmly. "We do not need torches. Nothing will bother us in the dark. But the light may anger them."

Pete fairly yelled, "Nothing will bother us? Are you stupid? Didn't you see —"

Kal smiled. "They have been around us all along. We knew, but did not want to alarm you. There is no radiation of menace. Even the bear was only curious, and now that he's seen the size of our cats he'll stay away."

Pete muttered an obscenity and raised his airgun a little. Murno's patience shattered. "Damn it! If you're not up to coming along, go on back! Or follow us with torches. I'm going ahead!" He turned and followed the blue men.

It was surprising how far down the path the torch light traveled, and how stubbornly his instincts clung to it. But once he was beyond it — the men were following, slowly — the prickling of his skin eased a little. He was all right.

This wasn't a normal forest. Well, he could accept that. He didn't think it was Gaddyl technology, and he had faith in Kal's ability to sense menace. And now, without the comparatively noisy Sierras close behind him, he could hear more — the soft footfalls of the blue men, who, he was certain, deliberately allowed themselves to make a little noise for his guidance. And as time passed and his eyes struggled for ultimate adjustment, he became aware that the darkness was not absolute.

The trees all glowed, very faintly; not enough so he could see their shapes, but enough so he could half-see the path and the blue men trotting ahead of him. He resolutely ignored the other things with which his imagination peopled the Grove.

Yards ahead, someone screamed. Murno crouched, knife drawn, straining his senses. There was no further sound except some faint vague murmurs — not human, he thought. The cats were very silent. Kal said, "It was this tree."

Murno moved close to the blue men. "What are you talking about?"

Kal took Murno's left hand and placed it against a smooth trunk. "I am glad the other Norms have dropped behind. They would have panicked. Here, trees make sounds and give off light. They are sentient, too. We can feel it dimly. Though I do not think they have real minds."

"But to *scream* . . ."

Kal said, "One of the girls screamed as she passed here, and the tree is only imitating the sound."

Liss put in, "You are brave and wise, Pale One, and the best bowmen we have ever seen. But your ears are dull. We have been hear-

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ing the trees ever since we entered."

Kal said, "Yes. And not all of the sounds are reassuring. But if you want to go on, we will not flinch."

Murno said. "I'm going on. At least, until one of these trees decides to knock me down and sit on me."

In the darkness, the young blues chuckled.

It was an hour more, at least, when he heard a distant call from behind, "Murno! Breloons!"

He stopped, almost beaten down with a sense of futility. The Sierra men — he thought it was Pete's voice — had just put themselves in bad trouble to warn him, and he couldn't go back to help, though he wasn't sure Pete had wits enough to evade the breloons.

He turned slowly, and heard the blue men start on. And now, as he followed on legs that shook with exhaustion, the forest murmured and remurmured the strange new sounds, "Mur-no. Breloooons. Mur-no."

It was morning, and the only way he knew it was that they passed a break in the forest, where the sky was visible, and around which the path detoured widely. The place looked like an old bomb scar. Years ago, probably, some Gaddyl hunting party had made an entry for themselves.

He only allowed himself a minute or two in the light, then forced himself on.

Some time later, when there seemed to be more light again, he thought at first that he was getting a little delirious. Soon, though, it was unmistakable. The foliage was much thinner, and the trees grew farther apart. He became aware that the path had dwindled until it hardly existed, though they were still near the stream.

Presently the blue men stopped, looking puzzled. The cats plopped down wearily. Kal said, "The scent is no longer here."

It took Murno a moment to realize he meant the childrens' scent. "Well, did they turn off?"

Liss back-tracked; found a place where the creek was shallow. "They waded across here. But something is not right."

Silently, Murno waded across and watched them searching for a track. Presently they moved on, away from the creek, southeast by his compass. The cats plodded behind, complaining wearily. Then the blue men halted again. Kal said, "The scent is all around us now."

Murno said impatiently, "Well, then, they rested here a while."

"No; it is not that." Kal stood, frowning, then suddenly blinked in surprise. "The trees are reproducing the scent!"

Murno stared at him, then snarled, "Hell! Now what?" He tried to get his tired brain working; finally said, "Well, I've got a compass. We'll just go on in a straight line, scent or no scent!"

A tree whimpered somewhere. Liss, ears cocked, said, "Let us try what we can feel." He sat down, cross-legged, and his brothers did likewise, forming a circle. They closed their eyes in concentration.

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Liss crooned a few soft tentative notes, and the forest shuddered. He opened his eyes, grinning like a child with a new toy, and sang a clear high note.

Back it came from every direction, loud and pure. Kal burst out, "Enough! Do you want the Gaddyl swarming around?" They got up, sheepishly.

Kal stood frowning for a minute, then said in a tone of wonder, "Why, they *belong* to someone! Someone — something — *uses* them! But in addition they have dim feelings of their own . . ."

Somewhere overhead there was the 'whoosh' of a fast-moving aircar.

Murno, remembering the Gaddyl had instruments to find fugitives by body-heat, stared upward, fists clenched with hate. "Let's move!" He forced himself into motion.

Here and there as they went the blue men found visible footprints. Liss said, "The Bigears did not come this far. The children went on alone. They walked close together, as if they were afraid. Maybe the trees talked to them, do you think?"

Murno didn't answer. His heart was pounding now, knowing as he did that the trail was only two or three hours old. Then he heard a child's voice, off to the left.

He whirled toward the sound, but Kal said, "It is only a tree. They will try to mislead us now."

While he stood in doubt, Murno heard, somewhere back along the path, faintly, a breloon. He snarled an oath. "*That* was no fake!"

Kal's face was alert. "No. They are coming."

That galvanized Murno's mind into action. "You, Kal. If Liss comes with me, can the rest of you intercept them as you did before?"

"Maybe." Kal was already moving back the way they'd come; and Liss was starting on in the other direction. Murno struggled to catch up with him. Young voices were babbling now, tantalizingly, as if the children were just out of sight to the left. He looked appealingly at Liss, and flushed at the blue man's patient expression.

The voices stopped abruptly, as if their instigator recognized futility. Murno slowed. They ought to get off the direct track, he thought; parallel it to one side to avoid ambush. Then he realized the trees could see them anywhere.

Another aircar whooshed overhead. He halted long enough to swivel his instrument about. At least two Gaddyl craft were close by, and others not far away. He ran on.

He heard a child crying softly, somewhere ahead.

V

Futile or not, he and Liss circled and approached the spot from another direction.

The children were all there, looking scared and tired, but apparently unharmed. Sis, in her boyish leather clothes, sat against a tree trunk, knees drawn up before her, arms and head resting on them. One of the other girls was nibbling on a thumb-sized yellow fruit, and a cou-

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ple of the boys were chewing what seemed to be dried meat. There were two waterbags near the base of a tree.

Murno listened hard to the Grove noises for a minute, glanced at Liss, got a shrug, and stepped forward. "Sis!" he called quietly.

Her head jerked up and she stared at him an instant before bouncing to her feet. "Oh, Daddy!" She ran to him, threw her arms around his waist and buried her grimy face against him. "I knew you'd try to find us, but then I thought — I thought — that black woods was so awful! And we — we couldn't see the men who were b-bringing us, and —" She broke down in sobs.

The rest of them were gathered around now, jabbering in hushed voices. "Quiet!" Murno told them, gruffly to hide his own emotion, "We're not out of here yet!" He looked at one of the oldest boys. "Have you seen anyone since the Bigears — those little men with the deep voices — left you?"

The boy shook his head vigorously. "No! But there was food here. And every time we tried to leave something snarled at us. And the trees told us not to be afraid and just wait here."

Murno glanced around. "All right. Listen, all of you. There are breloons on our track, and Gaddyl flying around, so we've got to hide for a while. First of all we'll go" — he looked at his compass — "west. That way. Until we're near the dark part of the forest and not too far from the trail. We'll wait very quietly and listen. If things work out, we'll go back along the trail, but it won't be for a while. You've got to be very brave and quiet. Understand?"

They nodded. He told them, "Gather up the food, and those waterbags."

They started westward, the youngsters fearful at first. The trees made no sounds beyond faint echoes.

Before long there was an outburst of breloon cries from the direction of the trail. Murno faced that way, hands cupped behind his ears. The uproar turned to a rout, with the breloons fleeing westward. He listened until he was sure, then waved the children on. The breloons wouldn't run forever, which meant they'd be somewhere along the trail for a while. He asked Liss, "Do you feel anything from your brothers?"

"Only a . . . feel of caution. Or — yes! They're coming this way, but not in a straight line. They're separating. They're bothered about something, and —"

A deafening blast interrupted him. The ground shook; leaves rattled and some fell. Murno grabbed arrows, unslung his bow. The Gaddyl bomb couldn't have been more than a hundred yards behind them. He waved violently to Liss. "Get them moving! I'll stay back a minute to —"

"Daddy!" Sis protested in terror.

"Go on!" he told her savagely, "Liss can take care of you better than I can!" He gave her a shove; gestured fiercely at the rest of them. They went, in a ragged run, turning their heads to stare back.

He took cover behind some saplings and waited.

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He could no longer hear the children, though the forest was deathly silent now. It occurred to him that whatever controlled the Grove wouldn't want to show its tricks with Gaddyl around. He listened for their voices, but there was no indication they'd landed. A bird flew by, silently. He looked at his instrument. There was an aircar very nearly in the direction he'd sent the children. He turned that way, took a step.

A ripping sound came from that direction.

He recognized it — a heavy laser burning down through the trees. He ran as hard as he could, bow and two arrows gripped in his left hand, right grabbing for another. Girls screamed. There were sudden Gaddyl shouts and the excited barking of breloons. Now the forest was full of sound — shouts as if a large group of Norms was running toward the action. He heard a Gaddyl shout in the Gaddyl tongue, "Ignore that! It's a fake!" Breloons bellowed their sighting-call. Through the trees, he got a first glimpse of a child running this way. Then the others were in sight, and, beyond them, breloons coming fast. Somewhere, judging by the sound, Liss was surrounded and fighting. He yelled at the panicked youngsters, "Climb trees! They can't climb as high as you can!" He paused an instant to see Sis shinnying up a slender trunk, and others at least grasping the idea. He dashed toward the leading breloons, roaring as loud as he could, and they paused.

Now the trees took up his roar and further distracted the beasts. He flung himself toward the nearest one and it darted aside, snarling, uncertain. Then he saw Liss, backed against a tree, knife flying. Several breloons darted about him, warily. Two lay dead.

An aircar rested on the ground not far away, branches still smoldering around it. Two Gaddyl had stepped out with light hunting-rifles, and, grinning, were ready to cripple Liss so the beasts could tear him apart. They saw Murno and their faces changed. An instant, and their rifles were moving.

He recognized one of them as Guddun's younger brother.

He was astounded at the mad hatred that rose in him, even as his hands nocked an arrow, drew, and aimed. The young Gaddyl screamed just before the shaft reached him. It plowed into his midriff and his rifle went off wildly. Murno had another arrow nocked, but the second alien's rifle was already pointing at him and he knew he'd be too late.

Shafts suddenly converged on the alien, battering him down in a bewildered, crumpled heap. Other arrows — they had to be called that — struck at the breloons, not only the ones around Liss, but those that ringed Murno. Some collapsed in the first awful barrage. Others raced about mindlessly, shrieking, as Murno stood stupified at the source of the arrows.

The short thick barbs he'd noted on the trees were swivelling to follow the darting beasts. The in-

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dividual aim wasn't perfect — but the cumulative effect was awesome. Each barb, as it came to aim, suddenly elongated itself and shot with terrible force away from its trees.

Within seconds there wasn't a breloon on its feet. Each one that lay stirring drew more shafts, until the last moan of agony was still.

Somewhere behind Murno a voice said softly, "This way, Murno. I may not be able to repel other air-cars from this spot."

He whirled, eyes darting, then realized some tree had spoken. Another, farther away, called softly. He went that way.

Liss, grinning with no sign of nervousness but rubbing at a few minor wounds, caught up with him. The children, urged gently by the trees, climbed down to follow. Liss said, "I am not unhappy that this weird forest had turned out to like you, Pale One." Murno grunted doubt, and looked at his instrument. Air-cars were headed this way.

Then he heard a clear high call, somewhere in the forest to his left.

Liss said casually, "Kal and my brothers will handle the other Gaddyl. The aliens will return home convinced the two dead ones were turned upon by their own breloons, and that they saw nothing else significant."

The children had all caught up by now. The voice came again. "The young ones are to stay here."

There was a chorus of protests, but the voice said firmly, "Stay here! The Norm called Pete and his men will be guided here and will escort you home."

Sis said forlornly, "Do I have to go with Pete, Daddy?"

Murno told her reluctantly, "I think you'd better, honey."

Now he and Liss were led for a long time, doubling back and circling. Murno recognized that a puzzle was being constructed for possible scent-trackers. As nearly as he could judge, they were several miles from where they'd left the children, and were somewhere near the creek, when the voice said, "Wait."

A few minutes later a huge blue form came into sight.

VI

Murno could only stare; and for once Liss's composure was missing too.

They both knew the Old One, of course — Liss's half-mutant ancestor — but this man, or creature, was to the Old One as the four friendly cats were to the huge maned lions of the Sak Toe valley. He was a foot or more taller than Murno; gnarled and knotted with muscles; his hands big enough to wrap around a Norm's throat, his biceps the size of Murno's thigh. His skin, like Liss's, was hairless except on the scalps and the long pointed ears, but it was as leathery as a bull's. Yet for all his bulk he walked as lightly as the Old One — only a little less lightly than Kal or his nephews. His face was lined and weathered with age, but he was nowhere near senile. Scars crisscrossed him, some of them fearful. At least two fingers were missing.

He smiled at Murno's wide-eyed

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inspection. His voice was powerful, with a deep timbre, but not loud nor harsh. "In the first few centuries of my life I was reckless and not very shrewd. Now I give more thought to my survival and that of the descendants I hope to have." He turned to Liss with an almost eager expression. "You, young one. Are you in some way a relative of mine? I have never heard of beings such as you."

Liss was too awe-struck to do more than mumble. Murno said, feeling half in a trance, "A thousand years. You're one of the two who escaped! It must be! How—?"

The being looked at him, a little impatiently. "I made it look as if I'd died, of course. You're the first Norm to see me in six or seven hundred years. If I let you and your daughter and the others go, you're never to tell about me. Do you understand? I have ways of killing you if you do."

Murno's face grew hot. "If you're the one who controls these trees, you know I'm no pal to the Gaddyl."

The being's mein softened a little. "That I saw. And it's one of two reasons you are still alive. The other is the blue companions you brought. Since this young man appears tongue-tied, can you tell me if I'm right in guessing they are part Norm?"

"Half Norm," Murno told him.

Liss finally found speech. "You have the ability to control trees. Can you not link minds with us as the Old One, our first ancestor, can?"

The huge being shook his head. "Plants I can control, and mutate, and understand. That was the reason we were created — to be gardeners. But we turned out too strong to suit the Gaddyl. This Old One? He is the son of a Norm woman and the mutant who escaped with me? Does he resemble you?"

"To some degree," Liss said, "but we are drifting back toward Norms with each generation."

The big creature was thoughtful for a while. "Then I am saved several hundred years of experimentation. I have mated with women of the Bigears, and with other mutants to the east, but none have born children. That is why I caused those Norm youngsters to be brought. Now —" He looked Liss up and down keenly. "What do you think, young one? Will I have to kidnap women of your people, or will it be arranged peacefully?"

Liss grinned. "You can discuss that with my uncle when he arrives. I, for one, want to know how three-quarters Blues will turn out."

The huge blue man said, "My trees tell me he'll be here before long." He turned to Murno. "I am glad I do not have to kill you, Normal; I like what I've seen of you. Go now, and catch up with your daughter, and begin inventing stories to hide my existence. I'll watch you safely out of the Grove. It may be that we shall meet again."

Murno looked at Liss, who showed no inclination to leave, then turned and plodded away. He did not permit himself to look back.

He was thinking with regret that, with only a normal lifespan, he would not live to see much of the Three-Quarters Blues. END

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HOLY QUARREL

by PHILIP K. DICK

ILLUSTRATED BY ADKINS

Earth was within moments of total annihilation — because of a simple pinball machine!

I

Sleep dissolved; he blinked as a dazzle of white artificial light hurt him. The light came from three rings which held a fixed location above the bed, midway to the ceiling.

"Sorry to wake you, Mr. Stafford," a man's voice came from beyond the light. "You are Joseph Stafford, aren't you?" Then speaking to someone else, also unseen, the voice continued, "Would be a damn shame to wake somebody else up — somebody who didn't deserve it."

Stafford sat up and croaked, "Who are you?"

The bed creaked and one circle of light lowered. One of them had seated himself. "We're looking for Joseph Stafford, of tier six, floor fifty, who's the — what do you call it?"

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"Computer G-B class repairman," a companion assisted him.

"Yes, an expert for example in those new molten-plasma data storage cans. You could fix one like that if it broke, couldn't you, Stafford?"

"Sure he could," another voice said, calmly. "That's why he's rated as standby." He explained, "That second vidphone line we cut did that; it kept him directly connected with his superiors."

"How long has it been since you got a call, repairman?" the first voice inquired.

Stafford did not answer; he fished beneath the pillow of the bed, groped for the Sneek-gun he generally kept there.

"Probably hasn't worked for a long time," one of the visitors with flashlight said. "Probably needs the money. You need any money, Stafford? Or what *do* you need? You enjoy fixing computers? I mean, you'd be a sap to enter this line of work unless you liked it — with you on twenty-four hour standby, like it is. Are you good? Can you fix anything, no matter how ridiculous and remote it is, that happens to our Genux-B military planning programer? Make us feel good; say yes."

"I — have to think," Stafford said thickly. He still searched for the gun, but he had lost it; he felt its absence. Or possibly before awakening him they had taken it.

"Tell you what, Stafford," the voice went on.

Interrupting, another voice said, "*Mr.* Stafford. Listen." The far right nimbus of light also lowered; the man had bent over him. "Get out of bed, okay? Get dressed and we'll drive you to where we need a computer fixed, and on the way when you have plenty of time you can decide how good you are. And then when we get there you can have a quick look at the Genux-B and see how long it'll take you."

"We really want it fixed up," the first man said plaintively. "As it is it's no good to us or anyone. The way it is now, data are piling up in mile-high mounds. And they're not being — what do you say? Ingested. They just sit there, and Genux-B doesn't process them, so naturally it can't come up with any decision. So naturally all those satellites are just flying along there like nothing happened."

Getting slowly, stiffly from the bed, Stafford said, "What showed up first as a symptom?" He wondered who they were. And he wondered which Genux-B they were talking about. As far as he knew there existed only three in North America — only eight throughout Terra.

Watching him get into his workshmock, the invisible shapes behind the flashlights conferred. At last one cleared his throat and said, "I understand that a tape take-up reel stopped spinning, so all the tape with all the data on it just keeps spilling onto the floor in a big heap."

"But tape-tension on the take-up reels —" Stafford began.

"In this case it failed to be automatic. You see, we jammed the reel so it wouldn't accept any more tape.

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Before that we tried cutting the tape, but as I guess you know it rethreads itself automatically. And we tried erasing the tape, but if the erase circuit comes on it starts an alarm going in Washington, D.C. and we didn't want to get all those high-level people involved. But they — the computer designers — overlooked the take-up reel tension because that's such a simple clutch arrangement. It can't go wrong."

Trying to button his collar, Stafford said, "In other words there're data you don't want it to receive." He felt lucid, now; at least he had more or less wakened up. "What kind of data?" He thought with chill foreboding that he knew. Data were coming in which would cause the big government-owned computer to declare a Red Alert. Of course, this crippling of Genux-B would have to occur before a hostile attack by the South African True Association manifested itself in real but minute individual symptoms which the computer, with its vast intake of seemingly unrelated data, would take note of — notice and add together into a meaningful pattern.

Stafford thought bitterly, how many times we were warned about this! They would have to wipe out our Genux-B prior to its successful deploying of the SAC retaliatory satellites and bombers. And this was that event; these men, undercover extensions in North America of S.A.T.A., had rousted him to complete their job of making the computer inoperable.

But — data might already have been received, might already have been transferred to the receptor-circuits for processing and analysis. They had started work too late; possibly by one day, possibly only by a few seconds. At least some of the meaningful data had gotten onto the tapes, and so *he* had to be called in. They couldn't finish their job alone.

The United States, then, would presently undergo a series of terror-weapon satellites bursting above it — as meantime the network of defensive machinery waited for a command from the cardinal computer. Waited in vain, since Genux-B knew of no trace harbingers of military assault — would still not ever really know until a direct hit on the national capital put an end to it and its emasculated faculties.

No wonder they had jammed the take-out reel.

II

"The war's begun," he said quietly to the four men with flashlights.

Now that he had turned on the bedroom lamps he could make them out. Ordinary men with an assigned task; these were no fanatics but functionaries. They could have worked equally well for any government, perhaps even the near-psychotic Chinese People's. "The war has *already* broken out," he guessed aloud, "and it's essential that Genux-B not know — so it can neither defend us nor strike back. You want to see it get only data which indicate we're at peace." He — and no doubt they — recalled how swiftly in the two previous Interventions of Honor, one

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against Israel, one against France, Genux-B had reacted. Not one trained, professional observer had seen the signs — or had seen to what the signs led, anyhow. As with Josef Stalin in 1941. The old tyrant had been shown evidence that the Third Reich intended to attack the U.S.S.R., but he simply would not or could not believe. Any more than the Reich had believed that France and Britain, in 1939, would honor their pact with Poland.

In a compact group the men with flashlights led him from the bedroom of his conapt, into the outer hall and to the escy which led to the roof field. As they emerged, the air smelled of mud and dampness. He inhaled, shivered, and involuntarily gazed up at the sky. One star moved: landing light on a flapple, which now set down a few feet from the five of them.

As they sat within the flapple — rising swiftly from the roof and heading toward Utah to the west — one of the gray functionaries with Sneekgun, flashlight and briefcase said to Stafford, "Your theory is good, especially considering that we woke you out of a sound sleep."

"But," a companion put in, "it's wrong. Show him the punched tape we hauled out."

Opening his briefcase, the man nearest Stafford brought out a wad of plastic tape, handed it mutely to Stafford.

Holding it up against the domelight of the flapple, Stafford made out the punches. Binary system, evidently programming material for the Strategic Acquired-Space Command units which the computer directly controlled.

"It was about to push the panic button and give them an order," the man at the console of the flapple said, over his shoulder. "To all our military units linked to it. Can you read the command?"

Stafford nodded, and returned the tape. He could read it, yes. The computer had formally notified S.A.C. of a Red Alert. It had gone so far as to move H-bomb carrying squadrons into scramble, and also was requesting that all ICBM missiles on their assorted pads be made ready for launch.

"And also," the man at the controls added, "it was sending out a command to defensive satellites and missile complexes to deploy themselves in response to an imminent H-bomb attack. We blocked all this, however, as you now are able to see. None of this tape got onto the co-ax lines."

After a pause Stafford said huskily, "Then what data don't you want Genux-B to receive?" He did not understand.

"Feedback," said the man at the controls. Obviously he was the leader of this unit of commandoes. "Without feedback the computer does not possess any method of determining that there has been no counterattack by its military arm. In the abeyance it will have to assume that the counterattack has taken place, but that the enemy strike was at least partially successful."

Stafford said, "But there is no enemy. Who's attacking us?"

Silence.

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Sweat made Stafford's forehead slick with moisture. "Do you know what would cause a Genux-B to conclude that we're under attack?" A million separate factors, all possible known data weighed, compared, analyzed — and then the absolute Gestalt. In this case, the Gestalt of an imminent attacking enemy. No one thing would have raised the threshold; it was quantitative. A shelter-building program in Asiatic Russia, unusual movements of cargo ships around Cuba, concentrations of rocket-freight unloadings in Red Canada . . ."

"No one," the man at the controls of the flapple said placidly, "no nation or group of persons either on Terra or Luna or Domed Mars is attacking anybody. You can see why we've got to get you over there fast. You have to make it absolutely certain that no orders emanate from Genux-B to SAC. We want Genux-B sealed off so it can't talk to anybody in a position of authority and it can't hear anybody besides us. What we do after that we'll worry about then. 'But the evil of the day —' "

"You assert that in spite of everything available to it, Genux-B can't distinguish an attack on us?" Stafford demanded. "With its manifold data-collecting sweepers?" He thought of something, then, that terrified him in a kind of hopeless, retrospective way. "What about our attack on France in '82 and then on little Israel in '89?"

"No one was attacking us then either," the man nearest Stafford said, as he retrieved the tape and again placed it within his briefcase. His voice, somber and morose, was the only sound; no one else stirred or spoke. "Same then as now. Only this time a group of us stopped Genux-B before it could commit us. We pray we've aborted a pointless, needless war."

"Who are you?" Stafford asked. "What's your status in the federal government? And what's your connection with Genux-B?" Agents, he thought, of the Blunk-rattling South African True Association. That still struck him as most likely. Or even zealots from Israel, looking for vengeance — or merely acting out the desire to stop a war: the most humanitarian motivation conceivable.

But nevertheless, he himself, like Genux-B, was under a loyalty oath to no larger political entity than the North American Prosperity Alliance. He still had the problem of getting away from these men and to his chain-of-command superiors so that he could file a report.

The man at the controls of the flapple said, "Three of us are F.B.I." He displayed credentials. "And that man there is an elec-com engineer who as a matter of fact helped in the original design of this particular Genux-B."

"That's right," the engineer said. "I personally made it possible for them to jam both the outgoing programming and the incoming data-feed. But that's not enough." He turned toward Stafford, his face serene, his eyes large and inviting. He was half-begging, half-ordering, using whatever tone would bring results. "But let's be realistic. Every Genux-B has backup monitoring cir-

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cuitry that'll begin to inform it any time now that its programming to SAC isn't being acted on, and in addition it's not getting the data it ought to get. As with everything else it sinks its electronic circuits into, it'll begin to introspect. And by that time we have to be doing something better than jamming a take-up reel with a phillip's screwdriver." He paused. "So," he finished more slowly, "that's why we came to get you."

Gesturing, Stafford said, "I'm just a repairman. Maintenance and service — not even malfunct analysis. I do only what I'm told."

"Then do what we're telling you," the F.B.I. man closest to him spoke up harshly. "Find out *why* Genux-B decided to flash a Red Alert, scramble SAC and begin a 'counterattack.' Find out why it did so in the case of France and Israel. Something made it add up its received data and get that answer. It's not alive! It has no volition. It didn't just *feel* the urge to do this."

The engineer said, "If we're lucky, this is the last time Genux-B will malreact in this fashion. If we can spot the misfunction this time we'll perhaps have it pegged for all time. Before it starts showing up in the other seven Genux-B systems around the world."

"And you're certain," Stafford said, "that we're *not* under attack?" Even if Genux-B had been wrong both times before, it at least theoretically could be right this time."

"If we are about to be attacked," the nearest F.B.I. man said, "We can't make out any indication of it — by human data processing, anyhow. I admit it's logically thinkable that Genux-B could be correct. After all, as he pointed out —"

"You may be in error because the S.A.T.A. has been hostile toward us so long we take it for granted. It's a verity of modern life."

"Oh, it's not the South African True Association," the F.B.I. man said briskly. "In fact, if it were we wouldn't have gotten suspicious. We wouldn't have begun poking around, interviewing survivors from the Israel War and French War and whatever else State's done to follow this up."

"It's Northern California," the engineer said, and grimaced. "Not even all of California; just the part above Pismo Beach."

Stafford stared at them.

"That's right," one of the F.B.I. men said. "Genux-B was in the process of scrambling all SAC bombers and wep-sats for an all-out assault on the area around Sacramento, California."

"You asked it why?" Stafford said, speaking to the engineer.

"Sure. Or rather, strictly speaking, we asked it to spell out in detail what the 'enemy' is up to."

One of the F.B.I. men drawled, "Tell Mr. Stafford what Northern California is up to that makes it a hot-target enemy — that would have meant its destruction by SAC spearhead-assaults if we hadn't jammed the damn machinery . . . and still have it jammed."

"Some individual," the engineer said, "has opened up a penny gum

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machine route in Castro Valley. You know. He has those bubble-headed dispensers outside supermarkets. The children put in a penny and get a placebo ball of gum and something additional occasionally — a prize such as a ring or a charm. It varies. That's the target."

Incredulous, Stafford said, "You're joking."

"Absolute truth. Man's name is Herb Sousa. He owns sixty-four machines now in operation and plans expansion."

"I mean," Stafford said thickly, "You're joking about Genux-B's response to that datum."

"Its response isn't exactly to that datum per se," the closest of the F.B.I. men said. "For instance, we checked with both the Israeli and French governments. Nobody named Herb Sousa opened up a penny gum machine route in their countries, and that goes for chocolate-covered peanut vending machines or anything else remotely similar to it. And, contrarily, Herb Sousa maintained such a route in Chile and in the U.K. during the past two decades . . . without Genux-B taking any interest all those years." He added, "He's an elderly man."

"A sort of johnny apple-gum," the engineer said, and tittered. "Looping the world, sending those gum machines swooping down in front of every gas —"

"The triggering stimulus," the engineer said, as the flapple began to drop toward a vast complex of illuminated public buildings below. "may lie in the ingredients of the merchandise placed in the machines. That's what our experts have come up with; they studied all material available to Genux-B concerning Sousa's gum concessions, and we know that all Genux-B has consists of a long, dry chemical analysis of the food product constituents with which Sousa loads his machines. In fact Genux-B specifically *requested* more information on that angle. It kept grinding out INCOMPLETE GROUND-DATA until we got a thorough P.F.&D. lab analysis."

"What did the analysis show?" Stafford asked. The flapple had now berthed on the roof of the installations housing the central component of the computer, and, as it was called these days, Mister C.—in—C. of the North American Prosperity Alliance.

"As regards foodstuffs," an F.B.I. man near the door said, as he stepped out onto the dimly illuminated landing strip, "nothing but gum base, sugar, corn syrup, softeners and artificial flavor, all the way down the line. Matter of fact, that's the only way you *can* make gum. And those dinky little prizes are vacuum-processed thermoplastics. Six hundred to the dollar will buy them from any of a dozen firms here and in Hong Kong and Japan. We even went so far as to trace the prizes down to the specific jobber, his sources, back to the factory, where a man from State actually stood and watched them making the damn little things. No, nothing there. Nothing at all."

"But," the engineer said, half to himself, "when that data had been supplied to Genux-B —"

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"Then this," the F.B.I. man said, standing aside so that Stafford could disemflapple. "A Red Alert, the SAC scramble, the missiles up from their silos. Forty minutes away from thermonuclear war — the distance from us of one phillip's head screwdriver wedged in a tape drum of the computer."

To Stafford, the engineer said keenly, "Do you pick up anything odd or conceivably misleading in those data? Because if you do for God's sake speak up; all we can do this way is to dismantle Genux-B and put it out of action, so that when a genuine threat faces us —"

"I wonder," Stafford said slowly, pondering, "what's meant by 'artificial' color."

III

"It means it won't otherwise look the right color, so a harmless food-coloring dye is added," the engineer said presently.

"But that's the one ingredient," Stafford said, "that isn't listed in a way that tells us what it is — only what it does. And how about flavor?"

The F.B.I. men glanced at one another.

"It is a fact," one of them said, "and I recall this because it always makes me sore — it did specify artificial flavor. But heck —"

"Artificial color and flavor," Stafford said, "could mean anything. Anything over and above the color and flavor imparted." He thought: Isn't it Prussic Acid that turns everything a bright clear green? That, for example, could in all honesty be spelled out on a label as "artificial color." And taste — what really was meant by "artificial taste"? This to him always had a dark, peculiar quality to it, this thought; he decided to shelve it. Time now to go down and take a look at Genux-B, to see what damage had been done to it.

— And how much damage, he thought wryly, it still needs. If I've been told the truth; if these men are what they show credentials for, not S.A.T.A. saboteurs or an intelligence cadre of one of several major foreign powers.

From the garrison, warrior domain of Northern California, he thought wryly. Or was that absolutely impossible after all? Perhaps something genuine and ominous had burgeoned into life there. And Genux-B had — as designed to do — sniffed it out.

For now, he could not tell.

But perhaps by the time he finished examining the computer he would know. In particular he wanted to see firsthand the authentic, total collection of data-tapes currently being processed from the outside universe into the computer's own inner world. Once he knew that —

I'll turn the thing back on, he said grimly to himself. I'll do the job I was trained for and hired to do.

Obviously for him it would be easy. He thoroughly knew the schematics of the computer. No one else had been into it replacing defective components and wiring as had he.

This explained why these men had come to him. They were right — at least about that.

"Piece of gum?" one of the F.B.I.

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agents asked him as they walked to the descy with its phalanx of uniformed guards standing at parade rest before it. The F.B.I. agent, a burly man, with a reddish, fleshy neck, held out three small brightly colored spheres.

"From one of Sousa's machine?" the engineer asked.

"Sure is." The agent dropped them into Stafford's smock-pocket, then grinned. "Harmless? Yes, no, maybe. as the college tests say."

Retrieving one from his pocket, Stafford examined it in the overhead light of the descy. Sphere, he thought. Egg. Fish egg; they're round, as in caviar. Also edible; no law against selling brightly-colored eggs.

Or are they laid this color?

"Maybe it'll hatch," one of the F.B.I. men said casually. He and his companions had become tense, now, as they descended into the high-security portion of the building.

"What do you think would hatch out of it?" Stafford said.

"A bird," the shortest of the F.B.I. men said brusquely. "A tiny red bird bringing good tidings of great joy."

Both Stafford and the engineer glanced at him.

"Don't quote the Bible to me," Stafford said. "I was raised with it. I can quote you back any time." But it was strange, in view of his own immediate thoughts, almost an occurrence of synchronicity between their minds. It made him feel more somber. God knew, he felt somber enough as it was. Something laying eggs, he thought. Fish, he reflected, release thousands of eggs, all identical; only a very few of them survive. Impossible waste — a terrible primitive method.

But if eggs were laid and deposited all over the world, in countless public places, even if only a fraction survived — it would be enough. This had been proved. The fish of Terra's waters had done so. If it worked for terran life it could work for non-terran, too.

The thought did not please him.

"If you wanted to infest Terra," the engineer said, seeing the expression on his face, "and your species, from God knows what planet in what solar system, reproduced the way our cold-blooded creatures here on Terra reproduce —" He continued to eye Stafford. "In other words if you spawned thousands, even millions of small hard-shelled eggs, and you didn't want them noticed, and they were bright in color as eggs generally are —" he hesitated. "One wonders about incubation. How long. And under what circumstances? Fertilized eggs, to hatch, *generally have to be kept warm.*"

"In a child's body," Stafford said, "it would be very warm."

And the thing, the egg, would — insanely — pass Pure Food & Drug standards. There was nothing toxic in an egg. All organic, and very nourishing.

Except, of course, that if this happened to be so, the outer shell of hard, colored "candy" would be immune to the action of normal stomach juices. The egg would not dissolve. But it could be chewed up in the mouth, though. Surely it wouldn't survive mastication. It would have to be swallowed like a pill: intact.

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With his teeth he bit down on the red ball and cracked it. Retrieving the two hemispheres, he examined the contents.

"Ordinary gum," the engineer said. "'Gum base, sugar, corn syrup, softeners—'" He grinned tauntingly, and yet in his face a shadow of relief passed briefly across before it was, by an effort of will, removed. "False lead."

"False lead, and I'm glad it is," the shortest of the F.B.I. men said. He stepped from the descy. "Here we are." He stopped in front of the rank of uniformed and armed guards, showed his papers. "We're back," he told the guards.

"The prizes," Stafford said.

"What do you mean?" The engineer glanced at him.

"It's not in the gum. So it has to be the prizes, the charms and knick-knacks. That's all that's left."

"What you're doing," the engineer said, "is implicitly maintaining that Genux-B is functioning properly. That it's somehow right; there *is* a hostile war-like menace to us. One so great it justifies pacification of Northern California by hard first-line weapons. As I see it, isn't it easier simply to operate from the fact that the computer is malfunctioning?"

Stafford, as they walked down the familiar corridors of the vast government building, said, "Genux-B was built to sift a greater amount of data simultaneously than any man or group of men could. It handles more data than we, and it handles them faster. Its response comes in microseconds. If Genux-B, after analyzing all the current data, feels that war is indicated, and we don't agree, then it may merely show that the computer is functioning *as it was intended to function*. And the more we disagree with it, the better this is proved. If we could perceive, as it does, the need for immediate, aggressive war on the basis of the data available, *then we wouldn't require Genux-B*. It's precisely in a case like this, where the computer has given out a Red Alert and we see no menace, that the real use of a computer of this class comes into play."

After a pause one of the F.B.I. men said, as if speaking to himself, "He's right, you know. Absolutely right. The real question is, do we trust Genux-B more than ourselves? Okay, we built it to analyze faster and more accurately and on a wider scale than we can. If it had been a success this situation we face now is precisely what could have been predicted. *We* see no cause for launching an attack; it does." He grinned harshly. "So what do we do? Start Genux-B up again, have it go ahead and program SAC into a war? Or do we neutralize it—in other words unmake it?" His eyes were cold and alert on Stafford. "A decision one way or the other has to be made by someone. Now. At once. Someone who can make a good, educated guess as to which it is, functioning or malfunctioning."

"The President and his cabinet," Stafford offered tensely. "An ultimate decision like this has to be his. He bears the moral responsibility."

"But the decision," the engineer spoke up, "is not a moral question,

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Stafford. It only *looks* like it is. Actually the question is only a technical one. Is Genux-B working properly or has it broken down?

And that's why you rousted me from bed, Stafford realized with a thrill of icy dismal grief. You didn't bring me here to implement your jerry-built jamming of the computer. Genux-B could be neutralized by one shell from one rocket launcher towed up and parked outside the building. In fact, he realized, in all probability it's effectively neutralized now. You can keep that phillip's screwdriver wedged in there forever. And you helped design and build the thing. No, he realized, that's not it. I'm not here to repair or destroy; *I'm here to decide*. Because I've been physically close to Genux-B for fifteen years — it's supposed to confer some mystic intuitive ability on me to sense whether the thing is functioning or malfunctioning. I'm supposed to hear the difference, like a good garage mechanic who can tell merely by listening to a turbine engine whether it has bearing knock or not, and if so how bad.

A diagnosis, he realized. That's all you want. This is a consultation of computer doctors — and one repairman.

The decision evidently lay with the repairman, because the others had given up.

He wondered how much time he had. Probably very little. Because if the computer were correct —

Sidewalk gum machines, he pondered. Penny-operated. For kids. And for that it's willing to pacify all Northern California. What could it possibly have extrapolated? What, looking ahead, did Genux-B see?

It amazed him: the power of one small tool to halt the workings of a mammoth constellation of autonomic processes. But the phillip's screwdriver had been inserted expertly.

"What we must try," Stafford said, "is introduction of calculated, experimental — and false — data." He seated himself at one of the typewriters wired directly to the computer. "Let's start off with this," he said, and began to type.

Herb Sousa, of Sacramento, California, the gum-machine magnate, died suddenly in his sleep. A local dynasty has come to an unanticipated end.

Amused, one of the F.B.I. men said, "You think it'll believe that?"

"It always believes its data," Stafford said. "It has no other source to rely on."

"But if the data conflict," the engineer pointed out, "it'll analyze everything out and accept the most probable chain."

"In this case," Stafford said, "nothing will conflict with this datum because this is all Genux-B is going to receive." He fed the punched card to Genux-B, then, and stood waiting. "Tap the outgoing signal," he instructed the engineer. "Watch to see if it cuts off."

One of the F.B.I. men said, "We already have a line splice, so that ought to be easy to do." He glanced at the engineer, who nodded.

Ten minutes later the engineer,

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now wearing headphones, said, "No change. The Red Alert is still being emitted; that didn't affect it."

"Then it has nothing to do with Herb Sousa as such," Stafford said, pondering. "Or else he's done it — whatever it is — already. Anyhow, his death means nothing to Genux-B. We'll have to look somewhere else." Again seating himself at the typewriter he began on his second spurious fact.

It has been learned, on the advice of reliable sources in banking and financial circles in Northern California, that the chewing gum empire of the late Herb Sousa will be broken up to pay outstanding debts. Asked what would be done with the gum and trinkets constituting the goodies within each machine, law-enforcement officers hazarded the guess that they would be destroyed as soon as a court order, now being sought by the Assistant District Attorney of Sacramento, can be put into effect.

Ceasing typing, he sat back, waiting. No more Herb Sousa, he said to himself, and no more merchandise. What does that leave? Nothing. The man and his commodities, at least as far as Genux-B was concerned, no longer existed.

Time passed; the engineer continued to monitor the output signal of the computer. At last, resignedly, he shook his head. "No change."

"I have one more spurious datum I want to feed to it," Stafford said. Again he put a card in the typewriter and began to punch.

It appears now that there never was an individual named Herbert Sousa; nor did this mythological person ever go into the penny gum machine business.

As he rose to his feet, Stafford said, "That should cancel out everything Genux-B knows or ever did know about Sousa and his penny-ante operation." As far as the computer was concerned, the man had been retroactively expunged.

In which case, how could the computer initiate war against a man who had never existed, who operated a marginal concession which also had never existed?

A few moments later the engineer, tensely monitoring the output signal of Genux-B, said, "Now there's been a change." He studied his oscilloscope, then accepted the reel of tape being voided by the computer and began a close inspection of that, too.

For a time he remained silent, intent on the job of reading the tape; then all at once he glanced up and grinned humorously at the rest of them.

He said, "It says that the datum is a lie."

IV

"A lie!" Stafford said, unbelievingly.

The engineer said, "It's discarded the last datum on the grounds that it can't be true. It contradicts what it knows to be valid. In other words, *it still knows that Herb Sousa exists*. Don't ask me how it knows this; probably it's an evaluation from wide-spectrum data over an extensive period of time." He hesitated, then

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said, "Obviously it knows more about Herb Sousa than we do."

"It knows, anyhow, that there is such a person," Stafford conceded. He felt nettled. Often in the past Genux-B had spotted contradictory or inaccurate data and had expelled them. But it had never mattered this much before.

He wondered, then, what prior, unassailable body of data existed within the memory-cells of Genux-B against which it had compared his spurious assertion of Sousa's nonexistence. "What it must be doing," he said to the engineer, "is to go on the assumption that if X is true, that Sousa never existed, then Y must be true — whatever 'Y' is. But Y remains untrue. I wish we knew which of all its millions of data-units 'Y' is."

They were back to their original problem: who was Herb Sousa and what had he done to alert Genux-B into such violent, *sine qua non* activity?

"Ask it," the engineer said to him.

"Ask what?" He was puzzled.

"Instruct it to produce its stored-data inventory on Herb Sousa. All of it." The engineer kept his voice deliberately patient. "God knows what it's sitting on. And once we get it, let's look it over and see if *we* can spot what it spotted."

Typing the proper requisition, Stafford fed the card to Genux-B.

"It reminds me," one of the F.B.I. men said reflectively, "of a philosophy course I took at U.C.L.A. There used to be an ontological argument to prove the existence of God. You imagine what He would be like, if He existed: omnipotent, omnipresent, omiscient, immortal, plus being capable of infinite justice and mercy."

"So?" the engineer said irritably.

"Then, when you've imagined Him possessing all those ultimate qualities, you notice that He lacks one quality. A minor one — a quality which every germ and stone and piece of trash by the freeway possesses. Existence. So you say: if He has all those others, He must possess the attribute of being real; if a stone can do it, obviously He can." He added, "It's a discarded theory; they knocked it down back in the Middle Ages. But —" He shrugged. "It's interesting."

"What made you think of that at this particular time?" the engineer demanded.

"Maybe," the F.B.I. man said, "there's no one fact or even cluster of facts about Sousa that prove to Genux-B he exists. Maybe it's *all* the facts. There may be just plain too many. The computer had found, on the basis of past experience, that when so much data exists on a given person, that person must be genuine. After all, a computer of the magnitude of Genux-B is capable of learning; that's why we make use of it."

"I have another fact I'd like to feed to it," the engineer said. "I'll type it out and you can read it." Reseating himself at the programming typewriter he ground out one short sentence, then yanked the card from the bales and showed it to the rest of them. It read:

The computer Genux-B does not exist.

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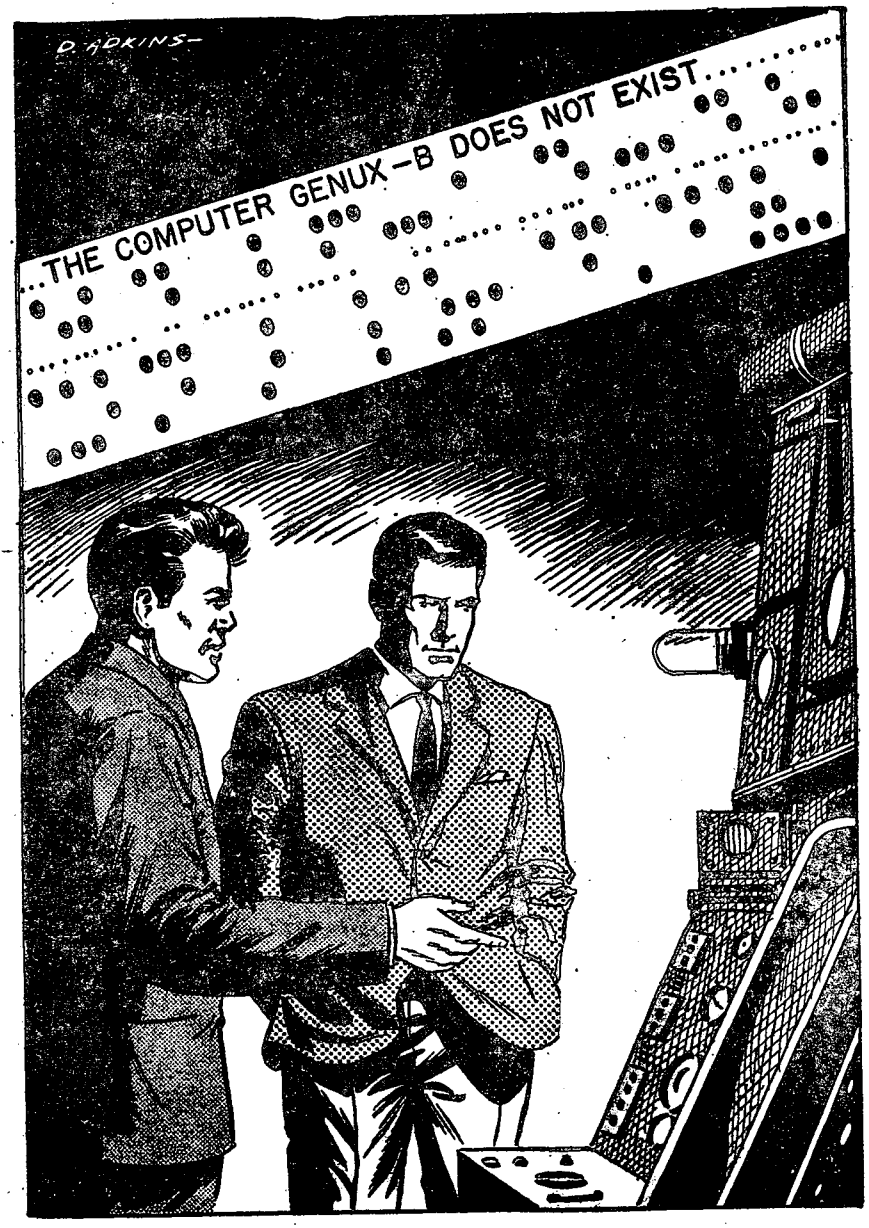

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After a stunned moment, one of the F.B.I. men said, "If it had no trouble in comparing the datum about Herb Sousa with what it already knew, it certainly isn't going to have any trouble with this — and what's your point, anyhow? I don't see what this accomplishes."

"If Genux-B doesn't exist," Stafford said, with comprehension, "then it can't send out a Red Alert; that's logically a contradiction."

"But it *has* sent out a Red Alert," the shortest of the F.B.I. men pointed out. "And it knows it has. So it won't have any difficulty establishing the fact of its existence."

The engineer said, "Let's give it a try. I'm curious. As far as I can see ahead, no harm can be done. We can always cancel out the phony fact if it seems advisable."

"You think," Stafford asked him, "that if we feed it this datum it'll reason that if it doesn't exist it couldn't have received the datum to that effect — which would cancel the datum right there."

"I don't know," the engineer admitted. "I've never heard even a theoretical discussion as to the effect on a B-magnitude computer of programming a denial of its own existence." Going to the feed bracket of Genux-B he dropped the card in, stepped back. They waited.

After a prolonged interval the answer came over the output cable, which the engineer had tapped. As he listened through his headphones he transcribed the computer's response for the rest of them to study:

Analysis of constituent re the non-existence of Genux-B multi-factor calculating instruments. If constit unit 340s70 is true then:

I do not exist.

If I do not exist then there is no way I can be informed that my generic class does not exist.

If I cannot be informed in that regard then you have failed to inform me, and constit unit 340s70 does not exist from my standpoint.

Therefore: I exist.

Whistling with admiration, the shortest of the F.B.I. men said, "It did it. What a neat logical analysis! He's proved — it's proved — that your datum is spurious; so now it can totally disregard it. And go on as before."

"Which," Stafford said somberly, "is exactly what it did with the datum filed with it denying that Herb Sousa ever existed."

Everyone glanced at him.

"It appears to be the same process," Stafford said. And it implies, he reasoned, some uniformity, some common factor, between the entity Genux-B and the entity Herb Sousa. "Do you have any of the charms, prizes, or just plain geegaws, whatever they are, that Sousa's gum machines dole out?" he asked the F.B.I. men. "If so, I'd like to see them . . ."

Obligingly, the most impressive of the F.B.I. men unzipped his briefcase, brought out a sanitary-looking plastic sack. On the surface of a nearby table he spread out a clutter of small glittering objects.

"Why are you interested in those?" the engineer asked. "These things have been given lab scrutiny. We told you that."

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Seating himself, not answering, Stafford picked up one of the assorted trinkets, examined it, put it down and selected another.

"Consider this." He tossed one of the tiny geegaws toward them; it bounced off the table and an obliging F.B.I. agent bent to retrieve it. "You recognize it?"

"Some of the charms," the engineer said irritably, "are in the shape of satellites. Some are missiles. Some inter-plan rockets. Some big new mobile land-cannons.Some figurines of soldiers." He gestured. "That happens to be a charm made to resemble a computer."

"A Genux-B computer," Stafford said, holding out his hand to get it back. The F.B.I. man amiably returned it to him. "It's a Genux-B, all right," he said. "Well, I think this is it. We've found it."

"This?" the engineer demanded loudly. "How? Why?"

Stafford said, "Was every charm analyzed? I don't mean a representative sample, such as one of each variety or all found in one given gum machine. I mean every damn one of them."

"Of course not," an F.B.I. man said. "There's tens of thousands of them. But at the factory of origin we—"

"I'd like to see that particular one given a total microscopic analysis," Stafford said. "I have an intuition it isn't a solid, uniform piece of thermoplastic." I have an intuition, he said to himself, that it's a working replica. A minute but authentic Genux-B.

The engineer said, "You're off your trolley."

"Let's wait," Stafford said, "until we get it analyzed."

"And meanwhile," the shortest of the F.B.I. men said, "we keep Genux-B inoperative?"

"Absolutely," Stafford said. A weird weak fear had begun at the base of his spine and was working its way up.

Half an hour later the lab, by special bonded messenger, returned an analysis of the gum-machine charm.

"Solid nylon," the engineer said, glancing over the report. He tossed it to Stafford. "Nothing inside, only ordinary cheap plastic. No moving parts, no interior differentiation at all. If that's what you were expecting?"

"A bad guess," one of the F.B.I. men observed. "Which cost us time." All of them regarded Stafford sourly.

"You're right," Stafford said. He wondered what came next; what hadn't they tried?

The answer, he decided, did not lie in the merchandise with which Herb Sousa stuffed his machines; that now seemed clear. The answer lay in Herb Sousa himself—whoever and whatever he was.

"Can we have Sousa brought here?" he asked the F.B.I. men.

"Sure," one of them said presently. "He can be picked up. But why? What's *he* done." He indicated Genux-B. "There's the trouble right there, not way out on the Coast with some small-potatoes type businessman working half the side of one city street."

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"I want to see him," Stafford said. "He might know something." He *has* to, he said to himself.

One of the F.B.I men said thoughtfully, "I wonder what Genux-B's reaction would be if it knew we're bringing Sousa here." To the engineer he said, "Try that. Feed it that non-fact, now, before we go to the trouble of actually picking him up."

Shrugging, the engineer again seated himself at the typewriter. He typed:

Sacramento businessman Herb Sousa was brought today by F. B. I. agents before computer complex Genux-B for a direct confrontation.

"Okay?" he asked Stafford. "This what you want? Okay?" He fed it to the data-receptors of the computer, without waiting for an answer.

"There's no use asking me," Stafford said irritably. "It wasn't my idea." But nevertheless he walked over to the man monitoring the output line, curious to learn the computer's response.

The answer came instantly. He stared down at the typed-out response, not believing what he saw.

Herbert Sousa cannot be here. He must be in Sacramento, California; anything else is impossible. You have presented me with false data.

"It can't know," the engineer said huskily. "My God, Sousa could go anywhere, even to Luna. In fact he's already been all over Earth. *How would it know?*"

Stafford said, "It knows more about Herb Sousa than it should. Than is reasonably possible." He consulted with himself, then abruptly said, "Ask it who Herb Sousa is."

"'Who'?" The engineer blinked. "Hell, he's —"

"Ask it!"

The engineer typed out the question. The card was presented to Genux-B and they stood waiting for its response.

"We already asked it for all the material it has on Sousa," the engineer said. "The bulk of that ought to be emerging any time now."

"This is not the same," Stafford said shortly. "I'm not asking it to hand back data given it. I'm asking for an evaluation."

Monitoring the output line of the computer, the engineer stood silently, not answering. Then, almost offhandedly, he said, "It's called off the Red Alert."

Incredulous, Stafford said, "Because of that query?"

"Maybe. It didn't say and I don't know. You asked the question and now it's shut down on its SAC scramble and everything else; it claims that the situation in Northern California is normal." His voice was toneless. "Make your own guess; it's probably as good as any."

Stafford said, "I still want an answer. Genux-B knows who Herb Sousa is and I want to know, too. And *you* ought to know." His look took in both the engineer with his headphones and the assorted F.B.I. men. Again he thought of the tiny solid-plastic replica of Genux-B which he had found among the charms and trinkets. Coincidence? It

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seemed to him that it meant something . . . but what, he could not tell. Not yet, anyhow.

"Anyhow," the engineer said, "it really has called off the Red Alert, and that's what matters. Who cares a goddam bit about Herb Sousa? As far as I'm concerned we can relax, give up, go home now."

"Relax," one of the F.B.I. men said, "until all of a sudden it decides to start the alert going again. Which it could do any time. I think the repairman is right; we have to find out who this Sousa is." He nodded to Stafford. "Go ahead. Anything you want is okay. Just keep after it. And we'll get going on it, too — as soon as we check in at our office."

The engineer, paying attention to his headphones, interrupted all at once, "An answer's coming." He began rapidly to scribble; the others collected around him to see.

> Herbert Sousa of Sacramento, California is the devil. Since he is the incarnation of Satan on Earth, Providence demands his destruction. I am only an agency, a so to speak Creature, of the Divine Majesty. As are all of you.

There was a pause as the engineer waited, clenching the ballpoint metal government-issue pen, and then he spasmodically added:

> Unless you are already in his pay and therefore working for him.

Convulsively, the engineer tossed the pen against the far wall. It bounced, rolled off, disappeared. No one spoke.

V

The engineer said finally, "We have here a sick, deranged piece of electronic junk. We were right. Thank God we caught it in time. It's psychotic. Cosmic, schizophrenic delusions of the reality of archetypes. Good grief, the machine regards itself as an instrument of God! It has one more of those 'God talked to me, yes He truly did' complexes."

"Medieval," one of the F.B.I. men said, with a twitch of enormous nervousness. He and his group had become rigid with tension. "We've uncovered a rat's nest with that last question. How'll we clear this up? We can't let this leak out to the newspapers; no one'll ever trust a G-B class system again. *I* don't. *I* wouldn't." He eyed the computer with nauseated aversion.

Stafford wondered, what do you say to a machine when it acquires a belief in witchcraft? This isn't New England in the seventeenth century. Are we supposed to make Sousa walk over hot coals without being burned? Or get dunked without drowning? Are we supposed to *prove* to Genux-B that Sousa is not Satan? And if so, how? What would it regard as proof?

And where did it get the idea in the first place?

He said to the engineer, "Ask it how it discovered that Herbert Sousa is the Evil One. Go ahead; I'm serious. Type out a card."

The answer, after an interval, appeared via the government-issue ballpoint pen for all of them to see.

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When he began by miracle to create living beings out of non-living clay, such as for example myself.

"That trinket?" Stafford demanded, incredulous. "That charm bracelet bit of plastic? You call that a living being?"

The question, put to Genux-B, got an immediate answer.

That is an instance, yes.

"This poses an interesting question," one of the F.B.I. men said. "Evidently it regards itself as alive — putting aside the question of Herb Sousa entirely. And we built it; or rather you did." He indicated Stafford and the engineer. "So what does that make us? From its ground-premise we created living beings, too."

The observation, put to Genux-B, got a long, solemn answer which Stafford barely glanced over; he caught the nitty-gritty at once.

You built me in accord with the wishes of the Divine Creator. What you performed was a sacred reenactment of the original holy miracle of the first week (as the Scriptures put it) of Earth's life. This is another matter entirely. And I remain at the service of the Creator, as do you. And in addition—

"What it boils down to," the engineer said drily, "is this. The computer writes off its own existence—naturally — as an act of legitimate miracle-passing. But what Sousa has got going for him in those gum machines — or what it thinks he's got going — is unsanctioned and therefore demonic. Sinful. Deserving God's wrath. But what further interests me is this: Genux-B has sensed that it couldn't tell us the situation. It knew we wouldn't share its views. It preferred a thermonuclear attack, rather than telling us. When it was forced to tell us it decided to call off the Red Alert. There are levels and levels to its cognition . . . none of which I find too attractive."

Stafford said, "It's got to be shut down. Permanently." They had been right to bring him into this, right to want his probing and diagnosis; he now agreed with them thoroughly. Only the technical problem of defusing the enormous complex remained. And between him and the engineer it could be done; the men who designed it and the men who maintained it could easily take it out of action. For good.

"Do we have to get a presidential order?" the engineer asked the F.B.I. men.

"Go do your work; we'll get the order later," one of the F.B.I. men answered. "We're empowered to counsel you to take whatever action you see fit." He added, "And don't waste any time — if you want my opinion." The other F.B.I. men nodded their agreement.

Licking his dry lips, Stafford said to the engineer. "Well, let's go. Let's destruct as much of it as we need to."

The two of them walked cautiously toward Genux-B, which, via the output line, was still explaining its position.

Early in the morning, as the sun began to rise, the F.B.I. flapple

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let Stafford off at the roof field of his conapt building. Dog-tired, he descended by descy to his own tier and floor.

Presently he had unlocked his door, had entered the dark, stale-smelling living room on his way to the bedroom. Rest. That was needed, and plenty of it . . . considering the night of difficult, painstaking work disassembling crucial turrets and elements of Genux-B until it was disabled. Neutralized.

Or at least so they hoped.

As he removed his work-smock, three hard, brightly-colored little spheres bounced noisily from a pocket to the floor of the bedroom; he retrieved them, laid them on the vanity table.

Three, he thought. Didn't I eat one?

The F.B.I. man gave me three and I chewed one up. I've got too many left, one too many.

Wearily, he finished undressing, crept into bed for the hour or so of sleep left to him. The hell with it.

At nine the alarm clock rang. He woke groggily and without volition got to his feet and stood by the bed, swaying and rubbing his swollen eyes. Then, reflexively, he began to dress.

On the vanity table lay four gaily-colored balls.

He said to himself, I *know* that I put only three there last night. Perplexed, he studied them, wondering blearily what — if anything — this meant. Binary fission? Loaves and fishes all over again?

He laughed sharply. The mood of the night before remained, clinging to him. But single cells grew as large as this. The ostrich egg consisted of one single cell, the largest on Terra — or on the other planets beyond. And these were much smaller.

We didn't think of that, he said to himself. We thought about eggs that might hatch into something awful, but not unicellular organisms that in the old primitive way divide. And they are organic compounds.

He left the apartment, left the four gum balls on the vanity table as he departed for work. A great deal lay ahead of him: a report directly to the President to determine whether all Genux-B computers ought to be shut down, and if not, what could be done to make certain they did not, like the local one, become superstitiously deranged.

A machine, he thought. Believing in the evil spirit entrenched solidly on Earth. A mass of solid-state circuitry diving deep into age-old theology, with divine creation and miracles on one side and the diabolic on the other. Plunge back into the Dark Ages, and by a man-made electronic construct, not by one of us humans.

And they say humans are prone to error.

When he returned home that night — after participating in the dismantling of every Genux-B style computer on Earth — seven colored spheres of candy-coated gum lay in a group on the vanity table, waiting for him.

It would create quite a gum-empire, he decided as he scrutinized the seven bright balls, all the same

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color. Not much overhead, to say the least. And no dispenser would ever become empty — not at this rate.

Going to the vidphone he picked up the receiver and began to dial the emergency number which the F.B.I. men had given him.

And then reluctantly hung up.

It was beginning to look as if the computer had been right, hard as that was to admit. And it had been his decision to go ahead and dismantle it.

But the other part was worse. How could he report to the F.B.I. that he had in his possession seven candy-coated balls of gum? Even if they did divide. That in itself would be even harder to report. Even if he could establish that they consisted of illegal — and rare — non-terrestrial primitive life forms smuggled to Terra from God knew what bleak planet.

Better to live and let live. Perhaps their reproduction cycle would settle down; perhaps after a period of swift binary fission they would adapt to a Terran environment and stabilize. After that he could forget about it.

And he could flush them down the incinerator chute of his conapt.

He did so.

But evidently he missed one. Probably, being round, it had rolled off the vanity table. He found it two days later, under the bed, with fifteen like it. So once more he tried to get rid of them all — and again he missed one; again he found a new nest the following day, and this time he counted forty of them.

Naturally, he began to chew up as many as possible — and as fast. And he tried boiling them — at least the ones he could find — in hot water. He even tried spraying them with an indoor insect bomb.

At the end of a week he had 15,832 of them filling the bedroom of his conapt. By this time chewing them out of existence, spraying them out of existence, boiling them out of existence—all had become impractical.

At the end of the month, despite having a scavenger truck haul away as much as it could take, he computed that he owned two million.

Ten days later — from a payphone down at the corner — he fatalistically called the F.B.I. But by then they were no longer able to answer the vidphone. END

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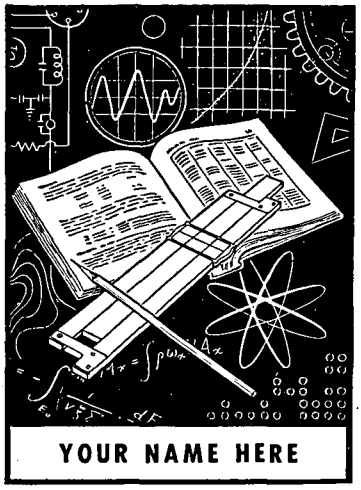

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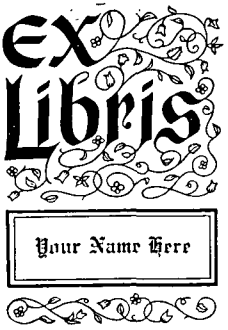

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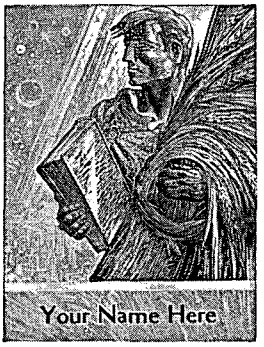

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